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THE
ELECTRIC TELEGRAPH:

WAS IT INVENTED BY

PROFESSOR WHEATSTONE?

BY

WILLIAM FOTHERGILL COOKE, ESQ.

PART II.,

CONTAINING

ARBITRATION PAPERS AND DRAWINGS.

“A frequently renewed and still unsettled controversy has arisen upon the point of who is to be considered the first contriver of the Telegraph in the form which made it available for popular use.”

QUARTERLY REVIEW for June 1854.

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ARTICLES of AGREEMENT
made this 16th day of November 1840,
between WILLIAM FOTHERGILL COOKE,
of Copthall-buildings, in the City of
London, Esq., of the one part, and
CHARLES WHEATSTONE, of Conduit-
street, Hanover-square, in the County
of Middlesex, Esq., of the other part.

WHEREAS the parties hereto are the co-proprietors of certain English, Scotch and Irish patents granted to them or one of them in and since the year 1837, for an invention commonly called the "Electric Telegraph," and for improvements thereon: AND whereas the said William Fothergill Cooke having represented to the said C. Wheatstone that he the said William Fothergill Cooke, has been subjected to constant annoyance and serious injury by alleged erroneous notions, which have been (as he states) generally received of his position relatively to the said C. Wheatstone, in consequence of alleged erroneous statements, alleged to have been contained in

First subject of
Arbitration.

a long series of widely circulated publications ; it has therefore been agreed between the parties hereto upon the said W. F. Cooke's application, that the relative positions of the said parties should be ascertained by arbitration as hereinafter mentioned :

Second subject
of Arbitration.

AND whereas the general property of the said patents is held and enjoyed by the parties hereto for their mutual benefit, subject to a deed dated the 18th day of November 1837, and executed by them for the purpose of regulating the enjoyment, management and development of their said invention, called the " Electric Telegraph," and of all improvements thereon, and of the British, Irish, Continental and American patents for the same : AND whereas the said Charles Wheatstone claims, by virtue of an understanding of subsequent date to the said deed, to be entitled for his separate benefit, apart from the said W. F. Cooke, to certain rights and benefits in England and elsewhere, in relation to certain parts and principles of the invention or improvements secured by and specified under the third and last of the said English patents for the said Electric Telegraph (which last patent is dated the 21st day of January last, and the specification thereof was enrolled on the 21st day of July last) : AND whereas the said W. F. Cooke does not deny or dispute that the said C. Wheatstone is entitled to separate rights and benefits as aforesaid, but, on the contrary, he hereby admits and declares that he has promised to the said C. Wheatstone that he would grant him the same ; and he hereby admits and declares, with

the qualification hereinafter mentioned, that he is now fully and irrevocably bound in honour, and that with the like qualification he is ready and willing immediately to bind himself in law, to secure to the said C. Wheatstone, in the most effectual and satisfactory manner possible, consistently with a due regard to the general interests of the said joint property, and subject to any details which may yet remain to be adjusted between the solicitors of the said parties, all such separate rights and benefits as aforesaid, to the full extent of the said W. F. Cooke's promises in that behalf: NEVERTHELESS, the said W. F. Cooke qualifies his aforesaid admissions to this extent; namely, he claims that every step which may be requisite for granting or securing such separate rights and benefits as aforesaid, should be separated from all other pending arrangements relative to the said joint property, and be postponed and reserved until the relative positions of the said parties should, in the first place, by arbitration or otherwise, be ascertained and publicly notified; And he also claims a right of inserting in recitals in all documents which he may be called upon to sign in relation to the said separate rights and benefits, a clear statement of the grounds expressed by the said parties at the time (whatever grounds were really then expressed), as the grounds upon which the said separate rights and benefits were claimed or asked for by the said C. Wheatstone, and conceded by the said W. F. Cooke: AND whereas the said parties hereto have

agreed that all matters in difference between them in any manner relating to the aforesaid claims of the said C. Wheatstone, shall be determined by arbitration as hereinafter mentioned: Now these presents witness, that in consideration of the premises, it is hereby mutually agreed between the said parties hereto, as follows; that is to say—

Appointment
of Arbitrators.

First, That Marc Isambard Brunel, of the Thames Tunnel, London, Esq., shall be Arbitrator on behalf of the said W. F. Cooke; and John Frederick Daniell, of Norwood, Surrey, Professor of Chemistry in King's College, London, Arbitrator on behalf of the said C. Wheatstone, for the purposes hereinafter mentioned.

Power to nominate a third
Arbitrator.

2dly. That the said Arbitrators shall, if they think fit, but not otherwise, nominate in writing, under their hands, before or after proceeding on the reference, a third Arbitrator for the same purposes. But if no such nomination shall be made, then the said two Arbitrators shall be the sole Arbitrators.

Arbitrators to ascertain the
relative positions of the
parties.

3dly. That the Arbitrators shall, with all convenient expedition, ascertain the relative positions of the said parties hereto, in the following manner, namely: The said Arbitrators shall investigate, and they or any two of them shall conclusively determine by their written award, in what shares and with what priorities and relative degrees of merit the said parties hereto are co-inventors of the Electric Telegraph, due regard being paid to the original projection thereof; to the development of its laws and properties; to the practical introduction of it

into the United Kingdom; to the improvements made upon it since its introduction there, and to all other matters which the Arbitrators, or any two of them, shall in their discretion think deserving of their consideration. That the said award shall be in such form as the Arbitrators making it shall in their absolute discretion think most conducive to the attainment of the purposes for which the said investigation is intended to take place; so that the same may either award simply to the effect that the said parties hereto stand upon equal terms, or that one stands superior to the other; or else the award may enter into details, distinctions and reasons, to whatever extent and in whatever manner the Arbitrators making it shall think proper. And that, subject to any contrary direction contained therein, the said award may be published and circulated at discretion by the said parties hereto, or either of them. And the Arbitrators, or any two of them, are hereby invested with unlimited powers as to the directing, restricting or controlling of such publication, and as to the preparing, directing or controlling of the publication of any statement or statements of any description (to be made in addition to the award itself), under the hands or hand of the said parties, or either of them, or of all, any, or either of the Arbitrators, or otherwise.

4thly. That all matters in difference between the said parties hereto in any manner relating to the aforesaid claims of the said C. Wheatstone, shall be and are hereby referred to the said Arbitrators, who

As to Professor Wheatstone's separate privileges.

shall at their discretion either determine the same in and by the award to be made by them as aforesaid, or by a separate written award to be made by the said Arbitrators, or any two of them; and that the said award or awards of the said Arbitrators, or any two of them, as the case may be, shall be final and conclusive upon both of the said parties hereto, and shall be in all things abided by, observed and performed by them respectively on their respective parts, provided the same be made and ready to be delivered to the said parties, or one of them, on or before the 31st day of December next, or on or before such ulterior day or days as the said Arbitrators, or any two of them, shall from time to time appoint, by writing under their hands and indorsed on both or either of the parts of these presents.

No actions, &c.
to be brought.

5thly. That the said parties hereto shall not bring any action or suit against the said Arbitrators, or any of them, or against each other, except for the purpose of enforcing the award or awards.

Examination
of parties and
witnesses.

6thly. That the said parties hereto shall and may be examined upon oath before the said Arbitrators, and that each party may, if he shall think proper, give his evidence in support of his own case; and that all witnesses who shall be examined before the said Arbitrators shall, if the said Arbitrators, or any two of them, shall think proper, be examined upon oath.

Papers, &c., to
be produced.

7thly. That the said parties hereto shall respectively from time to time produce before the said Arbitrators, or elsewhere, all such instruments,

models, drawings, books, papers, letters and writings, and other evidence of every description, in their respective custody or power, and relating to the matters hereby referred, as the said Arbitrators, or any two of them, shall require.

8thly. That the said Arbitrators shall have full power to receive any kind of documentary or other evidence not strictly admissible as legal evidence, if and when and under what conditions the said Arbitrators, or any two of them, shall think proper to receive the same. And that the said Arbitrators shall not be obliged to adhere strictly to the mere legal rights of the said parties, but, on the contrary, they are hereby empowered and directed to have regard to every consideration of equity and honour which they, or any two of them, may think binding upon the said parties, or either of them, in relation to the matters aforesaid.

Evidence not strictly legal may be received.

9thly. That if either party shall omit to attend before the said Arbitrators, after having had three days' previous written notice of an intended meeting, left at his dwelling-house or place of business, the said Arbitrators shall be at liberty to proceed ex-parte, if they, or any two of them, shall think fit.

Provision for non-attendance of either party.

10thly. That the costs of, and incidental to, this agreement, and to the said reference and award or awards, and the compensation to be paid to the said Arbitrators, shall be in the discretion of the said Arbitrators, or any two of them, who shall direct by whom and in what manner the same shall be paid.

As to Expenses &c.

Submission to
be made a rule
of Court.

11thly. That the submission hereby made shall be made a rule of the Court of Queen's Bench. In witness whereof the said parties to these presents have hereunto set their hands and seals the day and year first above written.

Signed, sealed and delivered	}	
by the above named Wil-		<i>Will^m. F. Cooke.</i>
liam Fothergill Cooke, in		(SEAL.)
the presence of		
<i>Rob^t. Wilson,</i>	}	<i>Charles Wheatstone.</i>
1, Copthall Buildings.		(SEAL.)

Signed, sealed and delivered by the
above-named Charles Wheatstone, in
the presence of

W^m. Richardson,
47, Bedford Row.

In the Matter of the ARBITRATION be-
tween WILLIAM FOTHERGILL COOKE
and CHARLES WHEATSTONE.

MR. COOKE'S STATEMENT OF FACTS TO
THE ARBITRATORS.

GENTLEMEN,

Circumstances which I deeply regret have forced 1.
upon me the painful necessity of at length appealing
to arbitration to refute a series of erroneous state-
ments which have been circulated in connexion with
the Electro-Magnetic Telegraph. The justice which
I claim from the Arbitrators is confined to a simple
practical point. I have often represented to Professor
Wheatstone, nor can I repeat the representation too
often, that I have no wish to encroach upon his
justly celebrated scientific researches; but on the
other hand, I maintain, and have always maintained,
that it is by me alone that the Electro-Magnetic
Telegraph was introduced into this country as a
practically useful invention. This claim may
hitherto have depended in some respects upon my

mere assertion; I rejoice that henceforth it must stand or fall by facts, deliberately and solemnly advanced, and supported by conclusive proof.

2. It is a happy circumstance that my claim does not impose upon me a necessity, or even a temptation, to depreciate the scientific merits of my eminent coadjutor. The philosopher's researches into the laws of nature are essentially distinct from the labours of the practical man who applies those laws to the purposes of daily life. I may therefore consistently yield to Professor Wheatstone a high rank among those scientific men, who for 20 or 30 years past have, in several countries, entertained theoretically the idea of an improved mode of transmitting intelligence. His telephonic experiments may still lead to important practical results; and I shall presently have occasion to mention that a principle which he had conceived before I knew him formed the basis, when ingrafted on my practical system, of a very valuable addition to the Electric Telegraph. In his more recent scientific researches in Electro-magnetism I claim no part whatever, and I readily acknowledge their merit. I am also happy to acknowledge how very much the Practical Electric Telegraph has been indebted to his eminent talent since I became acquainted with him.

3. The Arbitrators are probably aware that our Practical Electric Telegraph comprises two modes of applying electricity to telegraphic purposes; the "galvanometer" form, which acts by the deflecting

power of galvanometer coils upon magnetic needles; and the "mechanical" form, which, with fewer wires, gives its signals through the agency of the electro-magnet on mechanism. Every important part of our three specifications may be classed under one or other of these two heads. I shall 4. prove that I had projected, and in a great measure worked out, the entire basis of both modes of application, before Professor Wheatstone had advanced beyond the theoretical speculations of other philosophers. I shall prove the circumstance under which he became connected with the practical invention, when I, being on the eve of taking out a patent for it, consulted him, in common with Dr. Faraday and Dr. Roget, with a view to his scientific assistance. It will be shown that the very point to which my consultations were directed was at once the source and the object of those researches in electro-magnetism which have issued in his recent scientific discovery of the laws of the electro-magnet. Moreover, the well-known and experienced Mr. 5. Farey will inform the Arbitrators, that in our latest improvements, my new instruments are, in his opinion, the really practical form of the Electric Telegraph. But I wish to be understood that I do 6. not rest my claims only or principally on the ground of my having invented the instruments. I claim to be the Projector of that entire SYSTEM OF PRACTICAL OPERATIONS, which has embodied in the form of a useful practical invention the idea long floating in the scientific world of an Electric Tele-

graph; a system which can never be superseded by any improvements in the telegraphic apparatus.

7. If I am now enforcing what ought, if due, to be spontaneously yielded to me, it is on Professor Wheatstone, not on me, that the responsibility lies. For years past I have been constantly appealing to him to correct the misrepresentations which have been circulated in his favour, upon his authority, and in many cases by persons receiving their information from his own lips. The spirit in which I have always acted is expressed, along with a plain statement of the claim which I have consistently maintained, and which till within the last few weeks was never openly disputed, in the following letter, which I wrote to him more than two years ago:—

8. MY DEAR SIR, 22nd August, 1838.

I was surprised to hear this morning that the Association had already met; having anticipated some communication from you before your departure from London, under the supposition that you would introduce the Telegraph to the notice of the Savans there assembled. I have long been annoyed by the urgent requests of my friends to publish my claims to the invention, but invariably declined; more recently a well-known scientific personage has been most urgent to bring it forward at the present meeting, but I have refused for two reasons; first, as I believe an invidious feeling rather than zeal in my cause dictated his offer, but more especially as I prefer leaving my cause entirely in your hands, and thereby evincing my sense of the confidence you have placed in me by entrusting your pecuniary interest in the patent to my honour and control. So great a publicity has been given to the subject, that I cannot doubt it will be made a prominent topic in your section,

which will give you the most favourable opportunity of placing the facts briefly before the public in their true light. I believe you have ever considered me as the individual, by whose solitary exertions, for a lengthened period, the system was prepared for practical application, in other words as the Projector; and I employ your frequently repeated expression in saying that you consider us on an equal footing as inventors. The former post as Projector explains most satisfactorily to the world why my name takes the lead in the patent, without casting the slightest shade over yours as a scientific man. Do, my dear Sir, make a point of settling this question in the manner which your own feelings as a gentleman and man of science will dictate, that it may rest henceforth and for ever: our mutual good understanding, which I trust has been gradually strengthening, will be confirmed by this step. It is finally determined that iron and lead tubing only are to be employed on the Great Western Railway; a large supply of materials will be ready in a few days, when I expect to proceed rapidly.

Yours faithfully,

WILL^M. F. COOKE.

C. Wheatstone, Esq.

Trusting to Professor Wheatstone's extensive information for an account of the researches and experiments of others so far as they may be relevant, I proceed to a history of the Practical Electric Telegraph secured to us by our three English patents.

In the month of March 1836, I was engaged at Heidelberg in the study of anatomy, in connexion with the interesting and by no means unprofitable profession of anatomical modelling; a self-taught pursuit, to which I had been devoting myself with

9.

10.

11.

12.

March, 1836.
Origin of the
Practical Elec-
tric Telegraph.
Drawing I.,
Part A.

incessant and unabated ardour, working frequently 14 or 15 hours a day for about 18 months previous.

13. About the 6th of March 1836, a circumstance occurred which gave an entirely new bent to my thoughts. Having witnessed an electro-telegraphic experiment, exhibited about that day by Professor Möncke of Heidelberg, who had I believe taken his ideas from Gaüss, I was so much struck with the wonderful power of electricity, and so strongly impressed with its applicability to the practical transmission of telegraphic intelligence, that from that very day I entirely abandoned my former pursuits, and devoted myself thenceforth with equal ardour, as all who know me can testify, to the practical realization of the Electric Telegraph; an object which has occupied my undivided energies ever since.

14. Professor Möncke's experiment was at that time the only one upon the subject that I had seen or heard of. It showed that electric currents, being conveyed by wires to a distance, could be there caused to deflect magnetic needles, and thereby to give signals. It was, in a word, a hint at the application of electricity to telegraphic purposes; but nothing more, for it provided no means of
15. applying that power to practical uses. His apparatus consisted of two instruments for giving signals by a single needle, placed in different rooms, with a battery belonging to each; copper wires being extended between these two termini. The signals given were a cross and a straight line, marked on the opposite sides of a disc of card, fixed on a straw;

at the end of which a magnetic needle was suspended horizontally in galvanometer coils, by a silk thread. The effect of this arrangement was, that if a current was transmitted from either battery when the opposite ends of the wires were in connexion with the distant telegraphic apparatus, either the cross would be there exhibited by the motion of the needle one way, or the line by its motion the other way, according to the direction of the current. The apparatus was worked by moving the ends of the wires backwards and forwards between the battery and the coils.

Within three weeks after the day on which I saw the experiment, I had made, partly at Heidelberg and partly at Frankfort, my first Electric Telegraph, of the galvanometer form, which is now at Berne. It has been written for, and shall be laid before the Arbitrators. I used six wires, forming three metallic circuits, and influencing three needles. I worked out every possible permutation and practical combination of the signals given by the three needles, and I thus obtained an alphabet of 26 signals. I had invented the instrument which I called the DETECTOR; by means of which injuries to the wires, whether from water, fracture or contact, are readily traced; an instrument which in practice is never out of my hand, and without which the Electric Telegraph would be impracticable. But my principal improvement was, that my Telegraph did not merely send signals from one place to another, but that it was, even at that early period, a

16.

17.

18.

March 1836.
Mr. Cooke's
first Galvano-
meter Tele-
graph. Draw-
ing I., Part B.

19.

20.

March 1836.
Mr. Cooke's
Invention of
the Detector.
Drawing I.,
Part B.

21.

reciprocal telegraphic system, by which a mutual communication could be practically and conveniently carried on between two distant places; the requisite connections and disconnections being formed by pressing the fingers upon keys, and the signals being exhibited to the person sending, as well as to the person receiving the communication.

22. This improvement was effected by placing a system of keys permanently at each extreme end of the metallic circuit, and by providing each circuit with a cross-piece of metal for completing the continuity of the wires when signals were being received from the opposite terminus. The two signal apparatuses being thus thrown into the course of the metallic circuit, every signal was given at both ends concurrently; and the cross-piece was made to restore the circuit for a reply, on the first communication being completed. This united and reciprocal property is the basis of the Electric Telegraph, and is inseparable from the practical system. It has been my leading principle throughout, and has impressed itself even upon the forms of my instruments; their distinguishing characteristic from first to last being, that my keys and signals have always been joined together into one instrument, and the several instruments into one reciprocal system. In a word, the Arbitrators will here recognize the earliest form of the RECIPROCAL COMMUNICATOR, the fundamental condition of the Electric Telegraph under every varied mode of its operation.
- 23.
- 24.

My earliest apparatus thus comprised, in a complete though improvable form, two essential parts of my system of a Practical Electric Telegraph; viz. the Detector and the Reciprocal Communicator: a third of equal importance is the ALARUM, without which the Electric Telegraph would require to be constantly watched like ordinary telegraphs.

25.

March 1836.
Mr. Cooke's
Invention of
the Alarum.
Drawing III.,
Part C.

26.

Before the end of March 1836, I had invented the Alarum, which is still extant in my first Mechanical Telegraph. It was one of ordinary construction, worked by clockwork mechanism on the removal of a detent. My invention consisted in placing a voltaic magnet in such proximity to an armature of soft iron forming the tail-end of a lever detent, that when an electric current passed round the voltaic magnet, the magnetism which was for the moment excited in it attracted the tail-end of the lever, and by so doing drew its detent end out of the clockwork; but on the temporary magnetism ceasing with the cessation of the current, the attraction of the tail-end of the lever ceased also, and the detent end of it was then replaced in the clockwork by a reacting spring or balance weight.

27.

The principle of removing a detent by magnetic attraction, and replacing it by mechanical reaction, was not however confined to the Alarum, but on the contrary it was the basis of my Mechanical Telegraph itself. The first idea of it suggested itself to my mind on the 17th March 1836, during my journey from Heidelberg to Frankfort, when

March 1836.
Mr. Cooke's
first Mechanical
Telegraph.
Drawing II., C.

- reading Mrs. Somerville's work on the Physical Sciences; and the Arbitrators will find that I immediately afterwards applied the idea to a musical
29. snuff-box, being almost the only piece of mechanism I was then acquainted with. The striking advantage held out by the mechanical, in comparison with the galvanometer form was, that whereas the mode of giving signals by combinations of magnetic needles, each acted upon directly and separately by an electric current, involved the necessity of using several circuits, and consequently the expense of several wires; on the other hand, if the electric agency could be confined to the office of causing suitable interruptions or divisions in any kind of motion derived from an independent source, the necessity of a plurality of circuits would be avoided, for the diversity of the signals would then depend
30. upon the mechanism.

- It is no slight proof of the ardour and decision with which I was following out my views, that on the 15th April 1836, within six weeks from the day on which I was present at Möncke's experiment, and on which I first conceived, from that experiment, the idea of a Practical Electric Telegraph; my passport shows that I was on my way to London, whither I was going for the purpose of making my mechanical instrument, having already
31. prepared the drawings.

I arrived in London on the 22d April 1836, having left my pair of galvanometer instruments, with several books, models, and other things belonging

to me, in the custody of my family then residing at Berne; who on leaving that place during the summer of 1836, placed them in charge of a Colonel May at Berne, with whom they have remained ever since. It is not unimportant to add that William Hoppner, Esq., an intimate friend, who shared my entire confidence during my labours at Heidelberg and Frankfort, and who had thoughts of taking a part with me in my invention, will (before leaving the country, as he is on the point of doing, to take charge of a foreign Railway) confirm the truth of the most important parts of the above statement, and prove the correctness of drawings and models which I have prepared in anticipation of the arrival of the instruments themselves. 32.

On my arrival in London I applied myself almost night and day to the making of my mechanical instrument, and the perfecting of my system of telegraph generally; but it is unnecessary here to enter into a lengthened account of my labours, as it will be much easier for me to describe my first mechanical telegraph verbally, with the instrument itself lying before the Arbitrators. I must observe, however, that the Reciprocal Communicator (which was now for the first time self-acting) remains here, as in every subsequent form of the apparatus down to the present day, the fundamental condition of the Practical Electric Telegraph. To every form it is essential to place both or all the signal apparatuses in the course of the circuit, so as to present the signals to the operator as well as to the recipient; and each 33. 34.

terminal apparatus retains, under every variation of circumstances, the essential reciprocal property of forming itself alternately into the source of the electric action at one moment, and then restoring itself at the next into the bridge or conduit, by which the electric action of the opposite terminus may complete the continuity of its outward and homeward course.

35. It will be found that my earliest mechanism closely resembled that of a musical snuff-box. Pressure on keys completed the electric circuit; which magnetised the temporary magnet;—which attracted the tail-end of the detent, thereby drawing its upper end out of the train of wheels, and allowing the mechanism to move on by its own maintaining power, till the intervention of an appropriate pin upon the cylinder or barrel struck up the key; broke the circuit; caused the magnetism of the temporary magnet to cease, and therefore put an end to the attraction of the tail-end of the detent; and thus allowed the reacting spring to replace the detent in its resting position, and by so replacing it to stop the mechanism, at the time when the revolving dial was presenting before an opening in the frame of the apparatus, at each terminus, the requisite letter, figure or symbol; the same action restoring the bridge on the completion of each signal, and therefore interrupting only for the moment occupied by each signal its capacity of receiving a reply.

36. One feature in my musical snuff-box mechanism

was, as the Arbitrators will perceive, its “chronometric” arrangement. I borrow the term “chronometric” from Professor Wheatstone, in consequence of its having been habitually used by us in conversation, and without stopping to inquire into its strict propriety: the idea which I mean to express by it is this; that the signal to be given was determined by the proportion of a revolution, which the barrel was allowed to make without interruption; therefore, although some latitude was allowed for a variation in the speed of the different apparatuses, the successful transmission of intelligence depended to a certain extent upon a similarity of timing; any great variation of time would introduce confusion into the signals, and in proportion to every increase in the speed at which the signals were given, the latitude allowed for variation would become actually less, though remaining relatively the same; consequently, in proportion to the increased rapidity of a succession of signals, greater accuracy of mechanism would be required. Whereas, if the signals could be given by divisions of the mechanical motion similar to the divisions made by the escapement of a clock, the necessity of accurate timing would be altogether avoided; for it would then be only necessary that every intervention of the attractive force of the magnet should occasion or allow a motion of the pallet of each escapement, without its being necessary that a motion of the pallet should occupy, in each instrument, precisely at the same period of time.

“Chronometric” Mechanism explained and contrasted with the escapement principle. Drawing II., C, and Part D.

38. An instrument which is extant will afford, with other evidence, conclusive proof that the escape-ment principle occupied part of my attention as early as August 1836. It was first reduced to practice by Professor Wheatstone, three years later, as will be afterwards explained.

August 1836.
Mr. Cooke's
experiments
on the Escape-
ment.
Drawing II.,
Part D.

39.

40. During the months of June and July 1836, I employed my leisure moments in working out the details of my system into a written pamphlet or sketch, which is extant, and the date of which can be clearly proved. The Arbitrators will learn from it that (as early as July 1836) I had, in anticipation, worked out my practical system from the minutest official details, up to the remote and extended ramifications of an important political and commercial engine.

July 1836.
Mr. Cooke's
Pamphlet.

41. Towards the end of 1836, my mechanical instrument was nearly completed, and my funds nearly exhausted. Finding it therefore necessary either to turn my invention to an immediate profitable result, or to draw upon the resources of my friends, and preferring the former alternative, I obtained an introduction to several of the leading gentlemen connected with the Liverpool and Manchester Railway, and submitted to them, in January, 1837, my pamphlet and mechanical instrument, with a view to the practical adoption of the Telegraph in a tunnel for which some mode of conveying signals was required. The correspondence connected with this, my first endeavour to apply the Electric

December
1836.
Mr. Cooke's
endeavours to
introduce the
Telegraph
upon the
Liverpool and
Manchester
Railway.

Telegraph to railways, will be laid before the Arbitrators.

Before taking my instrument into the North, I showed it in November 1836 to Dr. Faraday, who kindly called at my lodgings in the Adelphi for the purpose of looking at it, and encouraged me by an assurance that I was right in principle. 42.

The Directors of the Railway Company thought my instrument, which was calculated to give 60 signals, of too complex a nature for the purpose of conveying a few signals along a tunnel; and therefore proposed that I should arrange one adapted for their purpose. I immediately designed and drew the second form of the mechanical telegraph, which was based upon the same principles as the first, but being calculated to give fewer signals was less complex. I returned to London immediately afterwards, and directed four instruments of the simpler form to be begun; which were soon afterwards made, and are extant. I had two of them working together at the close of April 1837. 43.

44.
February 1837
Mr. Cooke's
second Mechanical Tele-
graph.
Drawing III.,
Part E.

Professor Wheatstone states in his letter that these instruments were incapable of being practically applied. Such was not the case. They were perfectly qualified for performing the duty for which they were intended, in the Liverpool and Manchester Tunnel; and, as the letters will show, were only not applied in consequence of a pneumatic apparatus having been laid down before my instruments were complete. With Mr. Wheat- 45.

stone's improved magnets, they would work at long distances. The Arbitrators shall see them at work, if they will allow me to place them for a day or two in the hands of my mechanician, to repair the injuries of neglect.

46. While my four simpler mechanical instruments

February 1837
Mr. Cooke's
experiments on
the Electro-
magnet.

were being made, I employed myself in trying experiments upon the Electro-magnet, with a view to discover at what distance an electric current would excite the temporary magnetism required for moving the detent of the mechanism. For this purpose, I adjusted above a mile of wire in the chambers of Mr. Lane, in Lincoln's Inn; but the magnets and battery being ill-proportioned, my experiments were unsatisfactory. In this scientific difficulty I sought the assistance of Dr. Faraday, who advised me to increase the number of the plates of the battery proportionably to the length of the wires; an expedient which in some degree overcame the defects of the magnets. I also consulted Dr. Roget upon the same scientific point; explaining my motives, but without showing my instrument to him.

27th February
1837.
Mr. Cooke
consults Dr.
Faraday, Dr.
Roget,

47. Dr. Roget informed me that Professor Wheatstone had a quantity of wire at King's College, which might assist me in trying experiments upon the electro-magnet, and he advised me on that account to submit my difficulty to him. Using Dr. Roget's name as an introduction, I accordingly called the same day upon Professor Wheatstone at his residence in Conduit-street (on the 27th Febru-

and Professor
Wheatstone.

ary 1837); on which occasion I asked his advice upon the point which I had before submitted to Dr. Faraday and Dr. Roget. In the course of conversation, Professor Wheatstone intimated that he had long been engaged in experiments himself, to show at what distances signals could be given by electricity, to be applied to telegraphic purposes. Upon his thus introducing the subject of a telegraph, I felt myself bound to caution him that my inquiry had reference to the same object, and that I was about to take out a patent for an Electric Telegraph.

He politely invited me to King's College, where I found that in connexion with about four miles of wire, he was in the habit of using two galvanometers of different constructions, in his experiments on the effects of electric currents in deflecting magnetic needles. He had no apparatus of any kind for giving signals; but he had two key-boards, one of which was occasionally used in our experiments.

What he had done towards inventing the Practical Electric Telegraph was confined to the "permutating principle" of his key-boards. This principle, which diminished the requisite number of wires, was engrafted on my Reciprocal Telegraph, and became very valuable in connexion with later improvements; but, though diminishing the number of wires, the permutating keys by themselves, and without the later improvements, would have been more complex than my first galvanometer

48.

What Professor Wheatstone had done before Mr. Cooke consulted him. Drawing IV., Part F.

49.

keys; for each of the latter gave two signals by a single needle (the plan now adopted on the Black-wall Railway), while the former required the concurrent action of at least two keys and two needles.

50. Though Professor Wheatstone was, when I first consulted him, in possession of a valuable principle, he had gone no further. Except in the permutating principle, he was practically behind Möncke: for the latter had an instrument for giving signals, and Mr. Wheatstone had none. Even had all his apparent intentions been worked out, he would not then have fulfilled any of the fundamental conditions of the Practical Electric Telegraph;—the powers of detecting injuries to the wires, by fracture, water or contact; of attracting attention at the commencement of the communication; of sending signals alternately backwards and forwards by the same apparatus; and of exhibiting signals to the operator, as well as to the recipient. In a word, he had no detector; no alarum; no reciprocal communicator. The above facts need not depend on the mere recollections of either party, for if they be incorrectly stated, the contrary will be susceptible of proof; as Mr. Wheatstone's key-boards are still extant, and will be produced, and he acquaints me in a recent letter that "he was not only known to have been engaged in his instrument by all his scientific friends, but that it was even announced in public print before he knew of my existence." Assuming for the present that my statement is cor-

rect, he had when I first consulted him no more invented the galvanometer form of the telegraph, than the mechanical form.

On many occasions during the months of March and April 1837, we tried experiments together upon the Electro-magnet: our object being to make it act efficiently at long distances, in its office of removing the detent. The result of our experiments confirmed my apprehension that I was still without the power of exciting magnetism at long distances; a defect which was to be attributed, as we then suspected, and as Professor Wheatstone's recent discoveries have proved, to the defective proportions of the magnets. In this difficulty we adopted the expedient of a secondary circuit, which was used for some time in connexion with my alarum.

Shortly after I became acquainted with Professor Wheatstone, I made, in preparing for my patent, a second pair of galvanometer instruments; some parts of which, including the entire alarum, are extant. They contained my old signal apparatus slightly varied, and my moveable cross-piece; and in fact generally resembled the galvanometer instruments which I had made a year before, except in the addition of an alarum, which I adopted from my mechanical instruments, in conjunction with the secondary circuit; and also in an important principle which was partly suggested to me by Mr. Wheatstone's permutating keys, and partly belonged to my second mechanical telegraph, viz. the use of one common blank wire, which was in

51.

March and
April 1837.Messrs. Cooke
and Wheat-
stone's Expe-
riments on
the Electro-
magnet.
Drawing IV.,
Part G.

52.

53.

54.

April 1837.

Mr. Cooke's
second Galva-
nometer Tele-
graph.
Drawing IV.,
Part H.

55.

permanent connexion with both terminal batteries ; a principle by which I in fact transferred to the permutating keys a beneficial property, already mentioned, of my first Galvanometer Telegraph, which qualified it for giving, by the movements of single needles, a distinct class of signals, found highly valuable in practice.

56.
May 1837.
Formation of
Messrs. Cooke
and Wheat-
stone's part-
nership.

A definite result having been attained by our experiments, I invited Professor Wheatstone to join me in my patent. He has made, in his recent letter already quoted, the following statement respecting the circumstances of my proposal :—

57. “When you first proposed a partnership, you know how strongly I opposed it, and on what grounds I did so. I said that I felt myself perfectly confident of being able to carry out my views to the ends I anticipated; that I fully intended to do so, to publish the results, and then to allow any person to carry them into practical effect. I told you that while I admired the ingenuity of your contrivance, I had no opinion whatever of its applicability to the purpose proposed; and I urged that in the position in which I stood, to associate my name with that of any other person, would diminish the credit which I should obtain by publishing separately the results of my own researches. To this you replied that you were not seeking scientific reputation; that no difference could arise between us on this account; and that your sole object was to carry the project into execution, so that it should produce a profitable result.”

58. The above statement is in many respects substantially correct. I wished Professor Wheatstone to become my partner on account, and solely on account, of his scientific attainments; acting under

a conviction, which has since been amply confirmed, that he was eminently qualified to undertake the scientific department, while I engaged myself in the practical development of my invention. He “strongly opposed” my proposition, upon the ground that he did not think the invention likely to be profitable; and in consequence of that opinion he expressed himself to be unwilling to incur any risk or expense. He also mentioned that some thought it not quite consistent with the habits of a scientific man to be concerned in a patent, but added that he had already broken through that rule. I then offered him a sixth of the clear profits, without risk or expense, if he would become my scientific partner on those terms. He at once declined the latter offer, observing that he would lose credit by associating his name with mine otherwise than on equal terms. On my then telling him that I should proceed alone with my patent, he informed me that if I did so, he would immediately publish all that he had done; an intimation which gave rise to some rather warm discussions between us. I was only anxious that he should agree to one of two alternatives:—either that he should join me on fair terms or that he should defer his proposed publication till after the sealing of my patent; but he objected to both these alternatives.

Eventually, our partnership was formed at Mr. Lane's Chambers in Lincoln's Inn, early in May 1837; and Mr. Lane will prove that a very long discussion then took place between Mr. Wheat-

stone and myself as to money matters, and afterwards a very long discussion as to the priority of names in the patent. Mr. Wheatstone's own contemporaneous writing proves,

62. 1st, That with his written consent my name took the lead.
63. 2d, That he paid 80*l.* and I only 50*l.* towards the expense of the patent : and other contemporaneous written evidence will show that any surplus was to be divided, not in these proportions but equally.
64. 3d, Mr. Wheatstone's own writing also proves that I was allowed 130*l.* for past experiments.
65. These are FACTS which cannot be disputed, whatever may be the effect of them. Professor Wheatstone was allowed *nothing* for his experiments ; yet in the recent letter already quoted, he rests his claim to maintain his generally received position as inventor of the Electric Telegraph, mainly upon the ground, that " he alone, unaided, before he was acquainted with me, had carried into effect, *at a very considerable expense compared with his then limited means*, the extensive experiments on which all his
66. subsequent researches have been founded." His not having claimed any thing for the expensive experiments which he had made before the commencement of our partnership, presents a striking contrast to his conduct at a later period ; when

having, in the year 1839, brought a particular series of experiments to a practically useful issue, he asked and obtained an allowance of 100*l.* from the partnership for his expenses in those particular experiments, upon the express ground of the above original allowance to me; although at the time our legal agreements would have enabled me to refuse him any allowance.

One of the most important extant documents 67.
relative to the formation of our partnership, is a memorandum which was made out and agreed upon during the above interview at Mr. Lane's Chambers, as instructions to him to prepare an agreement for declaring our respective interests in the intended patent, and carrying into effect our pecuniary arrangements; without however entering into our ultimate plans, which were at that early period wholly unconsidered.

After the making of my second Galvanometer 68.
Telegraph, and immediately after the formation of May 1837.
our partnership, Professor Wheatstone invented his Mr. Wheatstone's Invention of the
Diagram with vertical astatic needles, a most im- Diagram.
portant practical improvement. He also, after the Drawing V.,
formation of our partnership, adopted into the Gal- Part J.
vanometer Telegraph the self-acting cross-piece, 69.
already used in the mechanical form.

In November 1837, our plans being more matured, 70.
and our active labours having commenced, we found 19 November
it necessary to make definitive arrangements for the 1837.
management of our joint property, and the settle- Messrs. Cooke
ment of our partnership generally. These arrange- and Wheatstone's part-
ment of our partnership generally. These arrange- 71.
ment of our partnership generally. These arrange-

ments were made in November 1837, under the auspices of Mr. Benjamin Hawes, M.P., to whom I had just before been introduced. He will give evidence as to the impression which the interviews which he had with us both together, and also with each of us separately, conveyed to his mind of our then relative position. Various written proposals were carried in before him, and eventually our partnership was established upon its present footing by a deed executed at his house on the 19th November 1837. The original proposals discussed at the above interviews, and bearing the alterations then made to meet the respective wishes of the parties, will be laid before the Arbitrators.

72. Passing over an interval of four months, I come to the month of April 1838, when I took out our second patent, for my intermediate and portable apparatuses. The principle of intermediate communication always formed a part of my general plan, and it will be found alluded to in my pamphlet of July 1836. It was introduced into our first specification in December 1837, so far as it was developed in my "Duplicate" instrument; an apparatus which had the capacity of exhibiting signals and sounding alarums at the intermediate point, without the power of communicating from the intermediate point to the termini. My "Intermediate" apparatus remedied the above defect, by providing means of communication from any fixed point to either terminus; and my "Portable" apparatus worked out the same principle still further, in the manner expressed by its name.

73. April 1838.
Mr. Cooke's
Invention of
the Interme-
diate and Port-
able Appa-
ratuses.
Drawing VI.,
Part K.

74.

75.

Among various other practical improvements secured by the second patent, was one which deserves to be specially mentioned, viz., my invention for removing the detent of mechanism by the direct blow of a magnetic needle; by which means, the inconvenient and very uncertain action of the secondary circuit of the alarum was for the first time avoided. The simple alarum described in the second specification is now in daily use upon the Blackwall and Great Western Railways, and works with unfailing certainty. I may in passing observe, that should we hereafter find the power of the needle insufficient for its object at very great distances, Professor Wheatstone's further and later improvement, described in our Third English Specification, may prove a valuable invention. Instead of removing the detent of the alarum by the blow of the needle itself, Professor Wheatstone interposes the needle between a hammer moved by clockwork and the detent, and thereby transmits the blow of the hammer to the detent; which the hammer cannot reach when the needle is not interposed. My application of iron conducting tubes was also secured by the second patent, being the only means yet devised by which the telegraphic wires can be effectually protected underground. I have also invented, and am now applying on the Blackwall Railway, an Air-pressure apparatus, to be used in connexion with the iron tubing, for keeping the inner surface of the tube under constant steady pressure, and thereby excluding water. This ap-

76.

April 1838.
Mr. Cooke's
application of
the direct
action of the
Magnetic
Needle to re-
move the de-
tent of mecha-
nism, &c.
Drawing VI.,
Part K.

77.

78.

79.

Drawing IX.
Fig. 7.

paratus will also serve as a warning index of any unsoundness in the tubing; and barometrical detectors will be applied at intervals to point out the locality of the unsoundness. The apparatus may be made to adapt the tubes to pass under water almost at any depth, on applying a proportionate pressure.

80. The second patent was taken out just before my experimental labours upon the Great Western Railway, the first real application of the Electric Telegraph. By incessant exertions during 14 months, and a voluntary sacrifice, not enforced by any contract, of 850*l.* of my own, when the Company declined to provide further funds, I at length surmounted a series of practical difficulties, of the extent of which no person who has not been a party to them can form an adequate conception. I have no doubt Mr. Brunel jun. will oblige me with his evidence upon this point, as I hope Mr. Robert Stephenson will also do with reference to my subsequent adaptation of the telegraph to the peculiar arrangements of the Blackwall Railway.
- 81.

82. About the month of June 1839, while engaged in my practical labours, I accidentally heard through a scientific channel that Professor Wheatstone had invented some new instruments. I called upon him and mentioned the circumstance. He said that he had been about to write to me, but as he appeared to be unprepared at the time to confide his invention to me, I offered to postpone his doing so till another day. On my calling upon him by appointment a
- 1838—1840.
Mr. Cooke's
practical labours upon the
Great Western
and Blackwall
Railways.
- June 1839.
Mr. Cooke
hears accidentally of Profes-
sor Wheat-
stone's new
instruments.

second and a third time, further postponements took place. Eventually, some months afterwards (early in November 1839), he showed me his new instruments: before doing so, however, he made certain proposals to me. The first was, that to enable him to keep some good workmen about him and to proceed with his experiments, he wished me to allow him the privilege of exclusively manufacturing his new instruments, for his own benefit, (the exclusive right of manufacturing all the instruments having been secured to me by the deed of November 1837). I said that nothing could be more reasonable, and unhesitatingly acceded to his request. Secondly, he wished me to give him the further privilege of introducing his new instruments into private use, for certain domestic and official purposes; alleging that such privilege could in no way interfere with my general interests and operations. This was ultimately agreed to, though I disapproved of a separation of interests. He also asked, upon the express ground of the novelty and originality of his invention, and of its applicability to other purposes besides telegraphing, that his name might be placed alone upon his instruments; to which I also assented. Some new continental arrangements were also proposed by him, and agreed to by me: he also asked and obtained "the right of establishing telegraphic lines between England and the Continent."

83.
November
1839.
Origin of Mr.
Wheatstone's
separate Pri-
vileges and
Claims.

84.

85.

86.

87.

As however we were already under engagements to Mr. Brunel, jun., to sell him a share in the patents, and in all future improvements, for a district

in the South west of England and Wales, I distinctly excepted the district included in this agreement; but on a further request from Professor Wheatstone, I consented to his applying to Mr. Brunel for a gift of similar privileges within the district: only stipulating that I was not to be called on personally to take any part in the transaction, beyond that of confirming Mr. Brunel's concessions, if any.

88. These proposals Professor Wheatstone calls "conditions"; and he has stated in his letter that he "required" them as a compensation for his valuable improvements. They certainly bore the appearance of conditions, for they were asked and in part conceded, as he himself states, before his improvements were confided to me; but surely he is wrong in regarding them as conditions which he could have "required," or which under the circumstances he was even justified in asking, for each party is bound by our partnership deed to throw into the common stock every improvement or invention connected with telegraphing by electricity, even though it should supersede the whole original invention, and to disclose it to the other without reserve or delay; a provision which gave Professor Wheatstone an equal share in the second patent, and has held a prominent place even in our arrangements with third parties. Its terms are so explicit and comprehensive that I think it desirable to extract the more important portion of it as follows:—

“That if at any time during the said term of 14 years 89.
 granted by the said recited” (1st English) “Letters-patent,
 or during any extension thereof, or during the original
 term to be granted by the said Letters-patent for Scotland,
 or any extension thereof; either of them the said William
 Fothergill Cooke and Charles Wheatstone shall invent or
 perfect any improvement or alteration in, or addition to the
 said invention, or shall become possessed of any such im-
 provement, alteration, or addition, by communication or
 otherwise, although such improvement, alteration, or
 addition should have the effect of entirely superseding the
 said original invention, provided only that it be applicable 90.
 to giving signals or sounding alarums solely or partially
 through the agency of electricity; in every such case the
 party making such invention, or becoming so possessed as
 aforesaid, shall without delay make a full and open dis-
 closure of such improvement, alteration, or addition to the
 other party, his executors or administrators, together with
 all necessary instructions and explanations relative thereto;
 and shall if possible keep the same secret from all other
 persons whomsoever; and that the same shall be subject, as
 nearly as circumstances will permit, to everything herein-
 before contained relative to the said original invention.”
 The clause continues at considerable length, providing 91.
 among other things that “all the aforesaid covenants rela-
 tive to the said recited Letters-patent, and the privileges
 thereby granted and to the management of the said original
 invention under the same, shall in all respects apply, in like
 manner, as nearly as circumstances will permit, to any
 patent or patents to be obtained in respect of any such
 improvement, alteration, or addition.”

It will be important that the Arbitrators should 92.
 keep in view the real nature of these separate pri-
 vileges, when the question of our pending agree-
 ment comes before them. They may then have to

- decide in favour of some of Mr. Wheatstone's claims as matters of right, and enforce them, as he has attempted to enforce them, against my protest ; or simply to confirm what I have conceded, and do still willingly concede to him, as a gratuitous and free gift out of my own rightful property solemnly
93. secured to me by our first agreement. But even while confirming to the extreme letter all I ever promised, the use Mr. Wheatstone has lately made of his separate privileges,—his efforts to extend them little by little, and even to transfer them to third parties, though bound to the contrary,—the interruption they have recently occasioned in an important agreement connected with our general interests, at a critical moment ;—all these circumstances combined force me to appeal to the Arbitrators, whether under the clause above extracted they were creditably obtained, and to protest that they have been used as ungenerously towards myself, as injuriously to the prosperity of the partnership.
94. Once more, I repeat that I do not seek to avoid performing my promise ; I always felt strongly however, how much better it would have been for us not to separate our interests, and I therefore at the time proposed to Professor Wheatstone that he should rather receive 95 per cent. of the partnership profits arising from the domestic and official uses of his instruments, than acquire a separate property in the patent. He then answered that the privileges would be valueless to him if limited in any way. I

still think however that if, with his consent, the Arbitrators could mediate some such arrangement as the above, or a sale to the partnership of the separate privileges at a fair price, their doing so would aid the progress of the invention, and be an act of friendship towards both parties.

His separate privileges having been conceded, Professor Wheatstone showed me his new instruments.

95.

November
1839.

Much as I admired the elegance of their form, I was astonished to perceive in them,—not the new and original invention I had been led to expect,—but

Mr. Wheatstone's new Instruments shown to Mr. Cooke.

an improved reproduction of my own mechanical arrangements. To this day, however, Professor

96.

Wheatstone maintains the entire originality of his invention. He states, in a recent letter, that after I had been some time his partner, “he commenced a series of researches on the laws of electro-magnets;” “that he was fortunate enough to discover the conditions, which had not hitherto been the subject of inquiry, by which effects could be obtained at great distances;” that “this rendered electro-magnetic attraction for the first time applicable, in an immediate manner, to telegraphic purposes;” that “he then proceeded to inquire how the principles he had ascertained could be best practically applied;” and that “the result was a variety of new instruments and apparatus,” which, in another part of the same letter, he declares to be “as original combinations as ever were put together.” I cannot but think that it would have been better and more correct, if he had said that he

97.

applied to "instruments and apparatus," based upon principles and mechanical arrangements which I had imparted to him, a discovery attained by those "researches on the laws of electro-magnets" to which I had directed his attention two years before.

98. Some time after Professor Wheatstone had shown me his new instruments we met on the occasion of taking out our third patent, when he asked for an allowance for the expense of his experiments. I pointed out to him that his experiments had benefitted himself, as his separate privileges had been granted in consideration of the results to which they had led. On his repeating his request, and urging that a similar allowance was made to me at the commencement of our partnership, I took up his account-book, and without further remark, put down 100*l.* to his credit. This allowance, which certainly could not be a "condition," may throw some light upon the real nature of the separate privileges.
99. If my forms of the mechanical telegraph had been publicly known, Professor Wheatstone might perhaps have been justified in calling his new instrument an original one, just as the inventor of an improvement in clockwork might without impropriety be called the inventor of a new clock; but the case is not at all analogous, if it be considered that my mechanical instruments were never made public, but confided only to a few individuals, and
100. among them to Professor Wheatstone himself. It

appears to me that it would have been better if on his having solved the scientific difficulty which I had submitted to him, he had immediately informed me of his success; and had thus, whilst himself applying his discovery, in his own way, to his own "combinations," left it open to me also to perfect my mechanical instruments which had been lying neglected for want of it. It appears by his letter that instead of thus acting frankly towards me, "he resolved to carry out his investigations alone, and to inform me only of the final results when obtained."

Much depends upon the correctness of my assertion that the two instruments are really in principle the same. The essence of both is the removal of a detent out of clock-work mechanism by magnetic attraction, and its restoration by mechanical re-action;—in my instruments sometimes by a spring, sometimes by a balance weight; in Professor Wheatstone's by a spring, as in my first instrument. The very peculiar connexions with the battery are exactly the same,—the alarum is the same,—the modes of exhibiting the signals are the same; the reciprocal action of the communicator is *not* the same, only because Professor Wheatstone has gone back to the imperfect principle of a moveable cross-piece, to be set at the end of the communication (although long ago rejected from the galvanometer form in consequence of the errors it occasioned in practice), while from the first and throughout my mechanical communicator has been self-acting, restoring itself after each individual signal.

101.
Mr. Wheatstone's new Instruments contrasted with Mr. Cooke's old ones. Drawing VII., Part L, and Drawing XI.

102. In making these observations, I am far from wishing to limit Professor Wheatstone's invention to a scientific discovery, however important. On the contrary he also made a practical improvement of great value, by realizing the escapement principle on which I had only experimented; and by thus superseding the "chronometric" division of the mechanical motion, and therefore the necessity of a degree of similarity in the speed of timing of
103. the different instruments. It is in his improved magnets, and in the practical realization of the escapement principle,—and in those respects only,—that his new instrument differs materially from
104. my old ones. The capstan communicator differs from my musical-snuff-box barrel, in making and breaking the circuit at each equal division of the mechanical motion; that is, in the escapement principle; but in other respects, my mechanical communicator still retains its essential identity. In both forms of the mechanical telegraph, there is a circular reciprocal communicator, divided into a number of equal parts: whether the operator's finger be used in the one case to move the communicator through a given number of those divisions up to a constant stop; or to stop it in the other case, when its own constant maintaining power has moved it through the same, or a relative, number of the divisions up to an occasional stop.

105.

December
1839.Mr. Cooke's
new Instru-
ments.
Drawing VII.,
Part M.

As soon as I was informed that effective magnets could be made, I immediately applied them to my old escapement instrument, worked, in common

with my first mechanical telegraph, by two magnets, and essentially different in principle from all the instruments with one magnet; and employing a third wire to alternate the circuit in correspondence with the alternation of the escapement, I obtained an instrument, so simple in its construction and certain in its action, that Mr. Farey has, as I have already mentioned, pronounced it to be the really practical form of the Electric Telegraph. The difference between the two forms of our last instruments is this; Professor Wheatstone has to remove his escapement detent, as in my old instruments and alarums, by magnetic attraction, which has to exert itself in the most unfavourable position of the parts, viz., when the escapement detent is removed to its greatest distance from the magnet, and is detained at that remote distance by the pressure of the maintaining power and of the reacting spring; consequently his instruments require to be of very delicate construction, and must be more or less exposed to the risk of failing in their action, especially at long distances: while on the other hand I move my escapement by clockwork, and use a magnet at each side of the escapement, thereby to detain it alternately as by an alternate detent; therefore the magnetic influence is exerted in my new instruments under the most favourable circumstances that can be conceived, for the escapement is thrown by a sure maintaining power up to the magnet, which has not to attract but merely to detain it.

106.

107.

108. My new instruments have also realized a principle which Professor Wheatstone proposed for a different and condemned purpose some years ago, I mean that of a metallic circuit constantly under
109. the electric influence. The application of the telegraph to railways having been from the first one of my leading objects, I have by means of the constant circuit, which dispenses with the portable battery, adapted my apparatus to the crying demands of railways; not only as a portable telegraph, but also as a self-acting one for tunnels, crossings and stations, causing a train to give notice of its own approach.
110. By an arrangement equally applicable, though unapplied to Mr. Wheatstone's communicator, the cross-piece of my new instrument is self-acting as in my earlier mechanical instruments; and consequently regains after each signal its capacity of receiving a reply, instead of being set like Mr. Wheatstone's at the end of the communication.
111. My concentric arrangement of the communicator, which may be traced in the concentric barrel of my old mechanical instruments, and which might be applied to Mr. Wheatstone's new instruments, seems to afford the best known mode of exhibiting the signals. It also presents an illustration of a remark which I made in a former page, that the characteristic quality of all my instruments of every form is their united and systematic, as well as reciprocal, construction; while Professor Wheatstone's have always been made more or less in detached parts,
112. *Supra*, 23.

Drawings
VIII. and IX.,
also VII.,
Part M.

and have generally realized in a less perfect manner the reciprocal system. I am disposed to think that a similar observation might be applied in general to our shares in the invention. Confining myself to a few essential points, which reappear again and again, always with a practical object, in all my instruments, I have for about five years been following out one leading general idea, to which I have clung with my whole mind; Professor Wheatstone has discovered most important natural laws,—he has invented the diagram,—and realised the escapement principle,—and adapted the communicator to the alternate action of the escapement,—and made other valuable detached improvements, in the intervals of his other occupations; but I cannot think that during “the long series” of 15 years before I knew him, in which, as he states, “the subject of telegraphic communication engrossed his thoughts,” he ever followed up his plans as I have since followed up mine, from an unwavering, apparent, and operative conviction that they could be worked out into a COMPREHENSIVE PRACTICAL SYSTEM, and be made available as a GREAT NATIONAL UNDERTAKING. 113.

Wheatstone's
Letter of 26
October, 1840.

With reference to his statement that, on the occasion of his communicating to me his new instruments, “I breathed not a word respecting the claim I have since put forward to be considered the joint inventor of them;” I can only state that before our understanding as to the separate privileges was definitively settled, and before we applied for our third English patent, I sent to Mr. Wheatstone 114.

some of my old instruments, which I had obtained from Liverpool for the express purpose, in support of my claim to include my new instruments in the

115. patent. I never did, and do not now, claim to be the "joint inventor of his new instruments." I only state, almost in words borrowed from his own letter, that my old mechanical instruments, the principles of which are embodied in his new instruments, were previously invented by me.

116. Among other reasons for disputing the originality of my new instruments, Professor Wheatstone states that they are "delicate like his, and not massive" like my old ones. My new instruments are decidedly less delicate than my old ones, both in construction and arrangement, and their being so is a striking practical merit. Perhaps, however, in Mr. Wheatstone's observation one great source of our differences may be discovered. He has attached, as it appears to me, too great importance to delicate movements, losing sight of originality of invention.

Wheatstone's
Letter of 26
October, 1840.

117. With the above observations, I leave it to the Arbitrators to compare for themselves our respective forms of the new instruments with each other, and also with my old mechanical telegraphs. And here I conclude the first part of my case. Without perplexing the inquiry with a multiplicity of technical details,—without professing to have alluded particularly to every part of our invention,—I have endeavoured to trace the Practical Electric Telegraph, from its origin in March 1836, through the

various stages of its progressive development. It is on the above simple and honest statement of facts, which shall be supported by conclusive and unanswerable proofs, and which must, I feel, speak home to the minds of the Arbitrators, that I appeal to their sense of justice. I now turn with reluctance to refute, in the second part of my case, several general charges which Professor Wheatstone has made against me in his letter dated the 26th October 1840, already several times quoted; and I shall conclude the case with a plain and specific statement of my charges against him. 118.

In the first place, Professor Wheatstone states in his letter that "he has more reason to feel aggrieved than I have." I am justified in claiming an explanation of the meaning of his complaint, and some proof in confirmation of it; and I call upon him to make it good by any means in his power. I must require that in common justice to me, he should produce, or at least give me a clue to, the "paragraphs" which he says "have appeared in the public papers, ascribing to me the chief and in some cases the sole merit;" for my part, I scarcely recollect to have ever seen my name mentioned fairly in print, except once in the Mechanics' Magazine. I must also call upon him to state before the Arbitrators, when and where I have allowed my friends to represent that "his share is merely that of advising me to carry out the details." In the meantime, I can only answer such a charge, by proving, as I shall do by evidence from Hastings, Rotherham, and 119.

Professor Wheatstone's charges against Mr. Cooke answered. 120.

121

122. Durham, that in the circle in which I move I have acted differently. With regard to the gentlemen with whom I am engaged in business, I hope the Arbitrators will hear from Mr. Brunel, jun., whether with him I have ever endeavoured to supplant my partner. Mr. Robert Stephenson, in a printed report to the Directors of the Blackwall Railway, spoke of the invention as "Professor Wheatstone and Mr. Cooke's" even while describing a practical plan arranged solely by myself for the peculiar occasion. Mr. Routh, the Chairman of the Company, after I had been acquainted with him for eight months, and had completed their telegraph, hesitated to pay me the price of the license, conceiving it to be due to Professor Wheatstone; and I accidentally heard the other day that Mr. Bidder, the engineer in charge of the line, with whom I am on terms of intimacy, conceives at this moment that Mr. Wheatstone is the inventor, and I his practical man of business. It would be scarcely possible to offer more convincing proof that I am no party to misrepresentation.

123. Professor Wheatstone has also interspersed in his letter several minor general charges, not weighing much in themselves, but leaving rather a painful feeling behind them. One of them is thus stated; "It was not long before I observed with regret, that when I proposed any improvement, or obviated any existing difficulty, you seemed to feel more jealous that I should be the first to suggest it than satisfaction at the result, and frequently at the same time

you were receiving with coolness my plans, you set yourself thinking how the same thing might be effected, not in a better, but in a different manner."

I am sorry he should have taken up such an impression, but I conscientiously believe that no charge could be more unfounded. I can prove that I have always been ready, by placing my men at his disposal and otherwise, to forward his experiments, even at my own expense, nor have I shown even any common favour to my own forms of the instruments. When he had imparted to me his diagram, I joyfully hailed it as a valuable improvement, and exerted myself in making the first model of it, and afterwards in directing the making of a pair of instruments for the London and Birmingham Railway after his models; adopting, as I can prove by his writing, all his wishes even in minute details. If I 124.
have ever appeared to neglect his wishes, it has only been when, as on two occasions which I remember, previous actual trials, or previous experience, convinced me beyond doubt that what he proposed would not answer; but in fact, he did not in general offer me any advice whatever in my department. I must expect that he will either state specifically 425.
before the Arbitrators the particular circumstances to which his general charge refers, or withdraw it. Another charge recorded in his letter complains 126.
"that I placed my name prominently first on all the instruments at the railway:" I formerly placed upon the instruments the names "Cooke and Wheatstone," in the same characters, and on the same

line, with the view of identifying our names with
 127. the Electric Telegraph. Our joint names appeared
 as above on six of the earlier instruments ; but as
 soon as I understood that this universal practice
 was disagreeable to my partner, I discontinued it,
 and have not placed any name upon any of the 20
 128. or 30 instruments since made. The charge is now
 gravely revived, nearly two years after I ever put
 any name upon any instrument.

129. Professor Wheatstone has devoted more than
 three pages of his letter to a series of statements
 from memory, by which he has endeavoured to do
 away the almost conclusive inference appearing
 to arise from the fact of my name taking the lead
 in the first English patent. In proceeding to ex-
 130. tract these statements, and to answer them seriatim,
 I repeat that although I use arguments in reply to
 Professor Wheatstone's prejudicial assertions, I trust
 my own case only to my simple statement of facts,
 and to my proofs in support of those facts.

131. I. PROFESSOR WHEATSTONE'S STATEMENTS AS TO
 THE FIRST ENGLISH PATENT ITSELF.

“ It was finally arranged that a patent should be taken
 out in our joint names, which should include our two
 separate instruments. (I.) When we met to settle the
 preliminaries of the English patent, I was much surprised
 with the claim you put forward to have your name inserted
 first ; (II.) I considered that as we put ourselves on an
 equality, by contributing each an invention ; (III.) to allow
 my name, which was well known, to follow yours which
 was then totally unknown, might be construed into my

admitting that your share was greatly superior to mine; (iv.) you urged that your pecuniary obligations were greater than mine; (v.) that as I intended to leave all negotiations with you, your authority would be less respected if your name appeared second; (vi.) and that your invention was more valuable than mine, (vii.) (an assumption which I did not admit, as I considered, what the result confirmed, mine to hold out the greatest promise of success). After some discussion it was finally agreed that my name and yours should stand alternately first in all succeeding patents (viii)."

ANSWERS.

(I.) It was arranged that a patent should be taken out for my two instruments, or rather for the two forms of my Practical Electric Telegraph, Professor Wheatstone having no instrument whatever but his key-boards. 132.

(II.) After a long discussion, the priority which I maintained was yielded to me. 133.

(III.) Professor Wheatstone made no claim to equality, contributing at first little or nothing but his valuable scientific attainments. 134.

(IV.) My right to the priority having been maintained and conceded, Professor Wheatstone's name did follow mine. 135.

(V.) My "pecuniary obligations" were not greater than Professor Wheatstone's, but less; as proved by his own writing. 136.

(VI.) The written document already mentioned, which was prepared at the time, as professional instructions for a deed, proves by its silence, that the "conduct of negotiations," *Supra* 67. 137.

in other words, the management, was not then under consideration. Moreover, Professor Wheatstone's subsequent mode of acting proves that instead of intending to leave "the conduct of negotiations" to me, he used his utmost endeavours to get the conduct of them into his own hands ; till I insisted on and obtained an arbitration, by means of which I invested myself with legal powers to act without his interference.

138. (vii.) Professor Wheatstone would have resisted most strenuously any thing claimed on the ground of superiority of invention, if the claim could have been answered.

139. (viii.) No such arrangement was made : and it may be observed that the statement that our names were to stand alternately first is inconsistent with the former statement that I took the lead as intended manager ; for though it might be desirable that the managing partner, as such, should stand first in all cases, it could not have been admitted or argued that it was desirable he should stand *alternately* first.

140. I solemnly and distinctly repeat that I claimed and took the lead in the first English patent, as Projector of the Practical Electric Telegraph ; and though I sincerely regret that my recollection upon any subject should differ so widely from my partner's, I am ready solemnly to maintain upon oath the substantial correctness of the statements made

by me in my final appeal; viz., that Professor Wheatstone sought the priority “on the ground that the merit of the invention would be of paramount importance to his reputation as a man of science,” and that “he did not even attempt, on any other ground, to answer my then undoubted and undisputed right to the pre-eminence.”

Cooke's Letter
of 20 October,
1840.

If it cannot be absolutely proved from his own letter that I was really acknowledged as the projector of the practical invention, he has at least mentioned some circumstances strongly corroborative of my positive and consistent statement that I was so acknowledged. He states, as I collect the dates,—

141.

“That from about 1823 to 1828, he was more or less engaged in his Telephone; by means of which he proposed to communicate between London and Edinburgh.

142.

“That in 1828, he transferred his attention from the Telephone to the Electric Telegraph, and thereupon undertook certain scientific inquiries, with the result of which the whole scientific world is acquainted.

143.

“That in 1829, his experiments were repeated, at the request of the Royal Society, with several miles of insulated wire, and that the results were witnessed by the most eminent philosophers of Europe and America; that he ascertained experimentally many of the conditions necessary for the production of effects in very long circuits, and that he devised a variety of instruments by which telegraphic communication should be realized on these principles.

144.

“That between 1828 and 1837, he proposed two electric telegraphs, on principles different from those of the Practical Electric Telegraph.

145.

“That he has given his almost exclusive attention to the Electric Telegraph, ever since he first conceived the idea of it.”

146.

147. Let the above be compared with the following statement, also taken from Professor Wheatstone's letter :

"That in May 1837" (at least eight or nine years after he 'first conceived the idea of the Electric Telegraph;' during the whole of which time, therefore, his 'almost exclusive attention' had been devoted to the subject) ; "he opposed a partnership with me,"—not because he had done anything, but—because "he felt himself perfectly confident of being able to carry out his views to the ends he anticipated;" because "he fully intended to do so," and—not even then to produce a practical invention, but—to "publish the results, and then to allow any person to carry them into practical effect."

148. Now let the above several statements be contrasted with the following plain facts :

That in March 1836, on seeing Professor Möncke's experiment, I at once and entirely gave up my professional pursuits, which I can prove to have been of a deeply interesting character ; and that I have devoted my whole energies of mind and body, from that very hour to the present day, exclusively to the practical realization of the Electric Telegraph.

149. That by July 1836, I had not only entered deeply into both modes of the practical invention, but had worked out into a written pamphlet an entire practical system of Electric Telegraphing.

150. That before the end of 1836, I was engaged in endeavouring to apply the invention to the Liverpool and Manchester Railway ; an endeavour which was in fact ultimately disappointed only in consequence of the opening having been pre-engaged.

That the instruments constructed for the above railway would now perform the duty for which they were made. 151.

That in May 1837, I offered Professor Wheatstone a share in my patent; but he objected to incur any expense, and objected also to my claim to priority: yet I took the priority; he paid the greater part of the expense; and even allowed me the whole expense of my one year's experiments, though receiving nothing himself for his experiments, which he describes as the "extensive experiments upon which all his subsequent researches have been founded," and which he states occupied his "almost exclusive attention" for several years, and had been "carried into effect by him at a very considerable expense compared with his then limited means." 152.

Lastly, that the patent having been sealed on the 12th June, I was introduced on the 27th June to Mr. Robert Stephenson; and on the 4th July was actively engaged in a course of experiments, at the expense of the London and Birmingham Railway Company, in their large carriage room at Euston-square, which had in the meantime been placed at my disposal: which course of experiments was begun, carried on with the utmost vigour, and finally approved by the engineer and the Directors, within three months and a half from the date of the patent, with the practical view throughout of laying down the Electric Telegraph from London to Birmingham; a project which failed, indeed, in 153.

consequence of an unwillingness on the part of the Liverpool Directors to incur, under existing circumstances, the necessary outlay, but on no other ground : the London Directors, and especially the chairman Mr. Glyn, having been decidedly in favour of the undertaking.

154. II. PROFESSOR WHEATSTONE'S STATEMENTS AS TO
THE SCOTCH PATENT.

“ Some time after this (I.) we met to arrange the preliminaries of the Scotch patent. You had already prepared the declaration ; on reading it over, I was surprised, after what had passed, to find that your name was placed first ; I objected to this as contrary to our previous understanding ; you said it had been done without your knowledge, but you objected to having it altered on account of the delay it would occasion. (II.) After some discussion, we came to a new arrangement ; on my allowing that your name should stand first in the British patents, (III.) mine was to take the lead in all Foreign patents which might be taken out (IV).”

ANSWERS.

155 (I.) The Scotch patent was applied for on the 31st August, after Professor Wheatstone had invented his Diagram, and when consequently he was in a position totally different from that in which he stood on the formation of our partnership. Therefore any argument derived from the Scotch patent, even if tenable (which I shall immediately show that it is not), would be of little force.

156. (II.) Mr. Lane will prove, as I have already

mentioned, that a very long discussion took place as to the priority of names in the first English patent, three or four months before the application for the Scotch patent. Six weeks after that application, our agreement with our American partners was on the point of being broken off, as I shall immediately show, by similar discussions. Professor Wheatstone states above, that he yielded to me the priority in the Scotch patent, "on account of the delay it would have occasioned to alter the declaration." Now the declaration is a short common form, kept ready prepared at the Patent Agents' Office, with blanks for the names and descriptions of the Declarants, and for the title of the invention. Therefore it is impossible that objections could have been made and answered; that discussions could have taken place, and a new arrangement have been come to, for the purpose of avoiding "the delay that would have been occasioned" by filling up a second form; and consequently, Professor Wheatstone's statement is inconsistent, not only with the facts, but even with itself.

(iii.) My name had previously stood first in the English patent as a matter of right; it now stood first in the Scotch patent as a matter of right; and it afterwards stood first in the Irish patent as a matter of right. 157.

(iv.) Professor Wheatstone's statement as to 158.

the priority in Foreign patents is in substance nearly correct ; and it leads me to explain in what sense, and to what extent, the priority of of names really was identified, or connected, with the management. Even at the commencement of our partnership, though the management was never brought under consideration, it was a clear tacit understanding that a leading position in the management of the practical invention which I had projected, and to which I had previously been devoting myself, would devolve upon me as a right which I would not give up ; and accordingly, the patent was no sooner sealed than I devoted myself to the active management. I have already mentioned my exertions upon the London and Birmingham Railway ; I was equally desirous of interesting the Great Western Railway Company in the invention, and with that view I was introduced to Mr. Brunel, jun. before the end of September ; an introduction which led to the subsequent adoption of the telegraph upon that line as far as Drayton. Nor was I without hope of attracting the notice of Government. On the 25th September, I was introduced to Mr. Benjamin Hawes, M.P. with that view ; and a few days afterwards he visited my experiments between Camden Town and Euston-square, in company with some Members of the Government. I have written evidence that some

time before the Scotch patent was taken out I had been exerting myself, though unsuccessfully, to obtain a partner for Scotland, who should advance the funds. With regard to Ireland, I had similar views, which were realized a few months later by our partnership with Mr. Lancaster.

In connexion with the countries which thus 163.
occupied my attention, I took the priority, not as incidental to my management, but as incidental, together with the management, to my projectorship. When I admitted Professor Wheatstone as my scientific partner, it was as far from my intention that he should, as it perhaps might be from my expectation that he would, interfere with the practical development of my practical invention. But he is nearly 164.
correct in his statement that I consented (and I think it was on the occasion of the application for the Scotch patent) to his name taking the lead in Foreign patents. I consented, in fact, that he should take the priority and management in any Foreign Countries in which he might be the means of introducing the invention. Retaining to myself the priority and management in the countries in which I was engaged, I could not in reason, nor did I wish to prevent Professor Wheatstone from applying himself, in like manner, to any other unoccupied field.

165. III. PROFESSOR WHEATSTONE'S STATEMENTS AS TO
THE AMERICAN PATENT.

"(I.) I did not expect that a similar circumstance would re-occur; but when it was resolved that an American patent should be obtained, and I attended to sign the preliminary papers again, I found that without any previous notice having been given me, my name was made to follow yours. I felt that this was not only unjust but a distinct breach of agreement: I used no importunities, as you state, but standing on these grounds I refused to sign the papers. You then consented to keep your word. (II.) The only reason you alleged on this occasion was, that your authority as manager would be diminished if you appeared as second partner (III.)."

ANSWERS.

166. (I.) These statements contain a very serious charge against me, which ought not to have been lightly made. I am happy to be in possession of evidence in Mr. Wheatstone's own writing proving it to be utterly groundless.

167. I assume that the expression "preliminary papers" refers to the agreement made between ourselves and our American partners on the 19th October, 1837, and not to the preliminary papers of the American patent which were prepared two months later. But, if the latter be meant, the original drafts of them shall be produced bearing Mr. Wheatstone's name every where placed first in their original form.

168. The real facts were simply these. I have written evidence that, at least a fortnight be-

fore the application for the Scotch patent, my friends were endeavouring to find us an American partner. About a month after the application for the Scotch patent, terms were concluded, solely through my interest, with the three American gentlemen who joined us. The arrangements having been satisfactorily settled by me alone, Professor Wheatstone asked for the American priority, on the ground that he understood that America was included in the "Foreign Countries" which were to be left open to him. Perceiving how the misunderstanding had arisen, though I could not admit the justice of such a claim as he had had no part in effecting the arrangement, I acceded to his wish, and allowed him the American management and priority. He had the draft of an agreement prepared by his then solicitor, which draft he handed to me. I found that it was so very defective (as he himself admitted) as to require to be redrawn. Finding that Mr. Wheatstone's professed management did not relieve me from the trouble of still attending to the business, I told him that if I were to attend to it I would take it entirely into my own hands again. Accordingly the American management was with his consent re-transferred to me. On the 12th October, I had another agreement drawn by my solicitor, in which my name was placed first; and a fair copy of that draft was, on the

169.

170.

171.

172.

16th October, submitted to Professor Wheatstone for his perusal and approval, at an interview which took place between us on that day, with a view to the draft being immediately afterwards submitted to our American partners. My priority gave rise to a new and warm discussion, which ended without either party giving way.

173. Previous interferences on the part of Professor Wheatstone had been very perplexing to me, and it had been proposed that some deed should be executed for regulating the management for the future; but the result of the above discussion annoyed one so much, that I went straight to my solicitor, and directed him to prepare the heads of a proper partnership agreement, which might be legally binding and clearly define our respective rights: being fully determined not to take another step in the management of the partnership business, without first obtaining a legal authority. The heads which were prepared by my solicitor on the same 16th October, required for me the American management and priority.

174. The friend, now deceased, by whom I had been introduced to our American partners, strongly deprecated, even upon considerations personal to himself, my allowing the American agreement to be broken off upon any such ground as the priority of names. I have a letter of his of the 17th October, expressing

these views. Influenced by his wishes and arguments, I called upon Professor Wheatstone on the 17th October, and yielded the point to him, upon the condition of our other differences being first satisfactorily adjusted. 176.

After the above interview, Professor Wheatstone resumed the American management, transposed our names, and submitted the agreement in that state to our principal American partner. I have a letter written by him to me late on the 18th or early on the 19th October, in a very friendly style; informing me that two engrossments were to go down to Liverpool on the evening of the 19th, with our signatures appended to them, and leaving it to me to determine whether his solicitor or mine should have the engrossments made. 177. 178.

Now, if my conduct at this time be contrasted with Professor Wheatstone's, it will be seen which of us was really the aggrieved and complaining party. Although less than a day remained to have the agreement engrossed and executed, and dispatched to our partners for execution by them, two of them being on the point of leaving the country; I required that before the execution of the agreement, our differences should be legally referred to arbitration. On the afternoon of the 19th, my solicitor, Mr. Wilson, received Mr. Wheatstone's and my own joint instructions for an 179. 180.

181. agreement of reference : there was barely time to prepare it, much less to engross it. Both parties met at Mr. Wilson's office in the evening of the 19th, just in time for the intended parcel to Liverpool. We read over the agreement of reference, and signed the rough draft; we then signed the American agreement; and we then walked with Mr. Wilson to the coach-office to book the parcel. So little time had we to spare, that the form of the receipt, which I still have, for the parcel, was written by Mr. Wheatstone himself, while Mr. Wilson was making up the parcel.

182. Mr. Benjamin Hawes, though a comparative stranger, kindly consented to be my Arbitrator; and eventually Professor Wheatstone requested

183. him to act for both parties. Immediately afterwards, an Arbitration took place before him, in which I claimed and maintained the entire management, and the exclusive right of working the invention in Great Britain, Ireland, and the Colonies; unfettered by Mr. Wheatstone, except in a particular and limited control reserved in his favour.

184. My claim to the projectorship was openly advanced throughout the arbitration, and was not disputed or questioned; and I took the lead in the partnership deed, as in the English, Scotch, and Irish patents, as a matter of right. Mr. Hawes himself will be called as a witness on these important points.

(II.) With reference to Professor Wheatstone's statement that "when he attended to sign the preliminary papers, he found that, without any previous notice having been given him, his name was made to follow mine; that he refused to sign the papers, and that I then consented to keep my word;"—not only is the apparent inference that I was endeavouring to exert an unjust influence over him at the last moment, an unfair and unwarranted one, but the statement itself is, as I have above shown, wholly erroneous and unfounded in point of fact. Mr. Wheatstone's friendly letter, leaving the engrossments to me, after the priority of names had been finally settled, and before he was or could be asked to sign any papers whatever; and the draft agreement, bearing a marginal note in these words, in his own writing, "Mr. Wheatstone's name to stand before Mr. Cooke's in all places where they are jointly mentioned;" concur in proving, beyond doubt or dispute, that the question of priority did *not* arise on any attendance to sign papers, or without the most ample previous notice; and that it was *not* determined by or in consequence of any refusal of signature.

(III.) With reference to my alleged reason for claiming the American priority, I admit that the management was so far identified with the priority, that I "alleged,"—not "that my

authority as manager would be diminished," but that I would not have any thing to do with the further management of a business which I alone had brought to a successful issue, "if I appeared as second partner."

188. IV. PROFESSOR WHEATSTONE'S CONCLUDING STATEMENTS AS TO THE PRIORITY.

"Your assertion, therefore, that I yielded to your superior claims at Mr. Lane's in 1837 is totally without foundation. (I.) From your making it now it might appear, that when, contrary to previous understandings, you endeavoured by persuasion and other means to have your name placed the first in all documents, it was with the intention that you might afterwards represent that I allowed your share in the inventions to be the most important. (II.) You cannot bring forward one word I have ever spoken, or one line I have written, in which I have admitted this claim; (III.) and you know well that it was only as co-proprietor and managing partner that I have consented your name should stand first in legal documents (IV.)." "I have ever ascribed the commencement of our misunderstanding to the omission of your instrument from the first patent; had it remained as at first intended, we should have appeared to stand on terms of equality there, and no difference would probably have arisen between us; but that having been given up as hopeless, and omitted, you thought it necessary to put forth claims to a greater share of the remainder than I could admit (V.)."

ANSWERS.

189. (I.) My assertion, whether right or wrong, is certainly not without foundation; it being admitted by Professor Wheatstone that my claim was made partly on the ground of supe-

riority of invention, and it being a fact that what I claimed was conceded.

(II.) Professor Wheatstone ought not to embitter our differences by ascribing unworthy motives to me. But the thing here stated is true, though unfairly presented; for I admit that I did claim and maintain the priority in consequence of its being a just and proper accompaniment of the "most important share in the inventions." But I put forward my claim openly at the time; I maintained it openly in the case of the English, Scotch, and Irish patents, and throughout the arbitration before Mr. Hawes; and I repeated it openly in my letter to Professor Wheatstone of the 22d of August 1838, copied above. Professor Wheatstone's claims are perfectly new, but mine have never changed. 190. Supra, 8.

(III.) The strongest evidence I have is furnished by Professor Wheatstone's own writing, though in his letters I admit that he has been most guarded. 191.

(IV) The American agreement, which was managed by me, and in which, on the 19th October, my name did *not* stand first, was a "legal document;" our partnership deed, in which, on the 19th November, my name *did* stand first, was the most important legal document we have been parties to, and I took the lead in it upon my avowed and undisputed footing of general superiority in the invention. 192.

Mr. Hawes will give his evidence upon this point.

193. (v.) The mechanical form of telegraph was not able to compete with the improved galvanometer form, while we remained unable to make effective magnets. It was not however "given up as hopeless," though under the best advice postponed. But "the commencement of our misunderstanding" cannot "be ascribed to the omission of my instrument" (namely of my mechanical telegraph) from the specification of the first patent; for such omission did not take place till nearly a month after the final decision of an arbitration to which our misunderstanding had previously given rise.
- 194.

195. Mr. Cooke's charges against Professor Wheatstone. MY CHARGES are not mere unsupported and inconsistent statements from memory, of supposed understandings which cannot be reconciled with circumstances; they are plain and incontestible facts. The former arbitration was required by me in consequence of Professor Wheatstone's interference with my proceedings, when carrying out my projection of the Electric Telegraph; when after full discussion I was protected for the future by the almost unlimited powers yielded to me by him. I have now again appealed to arbitration, as my ultimate protection against new encroachments.
196. The present arbitration is the immediate offspring of Professor Wheatstone's rejection of a remonstrance, admitted to be "written with temper,"

made by me to him by a letter dated the 20th October last, against a paragraph which was widely circulated in several papers in that month. The paragraph contained an eye-witness' account of certain experiments exhibited by him at Brussels; it was headed, in some papers at least, "Professor Wheatstone's Electrical Telegraph," and, without once intimating his connexion with a partner, ascribed to him the entire invention. The answer which I received was, that "of the paragraphs," which had been so widely circulated that even comparative strangers had obtrusively called my attention to them, Professor Wheatstone "knew nothing; they might be right, or they might be wrong, but he had given them no sanction."

197.

Some months previously, the Fourth Report of the Select Committee on Railways, dated the 2nd July last, was publicly circulated. It was made in the course of an inquiry into those practical questions which had formed my exclusive department. It was made upon Professor Wheatstone's own evidence; some of which was given from information received by him from me, and at a time when he knew that at the request of Mr. Saunders, the secretary of the Great Western Railway Company, I was waiting at the door of the Committee-room to give evidence if called in. I have no means of showing what his evidence really was, for it was corrected by him with the express view of removing any ground of complaint on my part, and the original notes cannot be obtained while Parliament

198

199.

is not sitting : but even as corrected and printed,
 200. the evidence is objectionable. Whatever were the words used by him, it is certain that his evidence conveyed to the mind of the Committee, some of whom were his personal acquaintances, and had seen his experiments at King's College, a totally wrong impression, as appears by the following extract from the Report:—

201. “ It appears that on the Great Western Railway, experiments have been made to a considerable extent with the view of ascertaining the best means of conveying intelligence through the medium of electricity.

“ Mr. Wheatstone, Professor of Experimental Philosophy in King's College, has for some years turned his attention to this subject, and has in conjunction with Mr. Cooke obtained patents for his inventions. From his evidence, which is especially deserving of notice, it appears that there is no difficulty in conveying intelligence to any part of the island, with an almost instantaneous rapidity, by means of a few copper wires and small galvanic batteries. There is great ingenuity in the various modes in which Mr. Wheatstone has applied the power of electricity to alphabetical communication.”

202. The impression embodied in the above Report existed at the time Professor Wheatstone gave his evidence, as appears by the first question put to the next witness, C. A. Saunders, Esq., viz. :—

“ As secretary of the Great Western Railroad Company, can you state to the Committee whether they have adopted Mr. Wheatstone's Magnetic Telegraph ?”

203. Statements like the above, going forth to the country under the sanction of Parliament, and

founded upon Professor Wheatstone's own evidence, exclude me from my fair position in connexion with the Electric Telegraph.

About the time the Report of the Committee was made public, an article appeared in Chambers's Edinburgh Journal of the 25th July last, founded upon experiments which had been exhibited, and explanations which had been given to Mr. Chambers at King's College, by Professor Wheatstone; and before the article appeared, Mr. Chambers had written to Mr. Wheatstone, as the latter himself told me, for additional information; but his letter was not answered, because Mr. Wheatstone thought he was going to publish. Here, then, is an article emanating immediately from Mr. Wheatstone's own experiments at King's College, exhibited and explained by himself to the author; an article very widely circulated, expressly upon his own authority, and not until after a written application for further information: surely here I might have expected to find that Mr. Wheatstone gladly availed himself of an easy opportunity of correcting the misapprehensions which had been repeatedly brought under his notice. On perusing an article of four columns, in which my name is not once mentioned, nor the remotest hint given that Mr. Wheatstone has a partner, the Arbitrators will find it stated that he has now made the Electric Telegraph his own;—that the first patent was effected by him alone;—that he has now superseded it by the third patent, which is also represented to be his alone;—that my

- detector—nay even my modes of insulating and laying down the wires—my very application (the result of many a disappointment) of iron tubes—the entire invention and every part of it—are all attributed, without exception or qualification, to
207. Mr. Wheatstone alone. His answer to my remonstrances on this head shall be extracted verbatim from his letter: “The experiments which I have been accustomed to show at the College have been entirely my own, and you have no right to complain that I did not go out of my way on every occasion to advertise your name to every person who visited me. I do not blame you for describing to your visitors your operations on the railway in the first person singular, you have an undoubted right to do so. When I have occasion to speak of the lines you are laying down, or of any thing you have done, I always mention your name with the praise
208. it deserves.” I can only add that the practical effect of the mention of my name is, that in the presence of my workmen I am addressed as Professor Wheatstone’s assistant, not only habitually by persons whom I meet on the business of the telegraph, but also occasionally (as I have told him) by gentlemen introducing themselves to me as his personal friends.
209. I am by some supposed to be the capitalist, though so low were our funds that the price of our first English patent was advanced to me without interest by a friend, and Mr. Wheatstone gave me his promissory note payable eight months after date for his share.

Had the above three publications—1st, the article 210.
in Chambers's Journal; 2dly, the Report of the
Select Committee; and 3dly, the paragraph on the
Belgian experiments, been circulated merely after
my letter of August 1838, copied above; had no ^{Supra 8.}
other appeal to Mr. Wheatstone been made; I might
even then have felt aggrieved if my subsequent re-
monstrances had met with a justification of palpable
mis-statements, and a refusal to contradict them.
But the case assumes a more serious aspect, when 211.
those mis-statements were circulated after Mr.
Wheatstone's own promise had given me reason to
expect that the subject of my complaints was about
to be removed.

The promise was given in July last, a few days 212.
before the date of the article in Chambers's Journal,
and in the course of a conversation which took place
in Lincoln's Inn during our joint labours in pre-
paring our third English specification. I frankly told 213.
Professor Wheatstone, that we never should go on
cordially together till he yielded to me my rightful
position, as the existing state of things induced on
my part a constant and unavoidable suspicion of
him; and I earnestly warned him that it might
soon be beyond his power to do me justice without
dishonour to himself. He assured me that he was 214.
extremely sorry that he had become involuntarily
placed in the position in which he found himself,
and we had a very long discussion as to the mode
in which he was to recede from it: the difficulty
which he seemed to feel most was, as he said, that I

215. claimed more than half; that I claimed to be the sole projector, and also the joint and equal worker-out of the invention. I replied that I would be satisfied with a perfect equality, which was all I asked; urging that his scientific discoveries were an ample balance to my projection. I suggested, as the most gentlemanly and agreeable mode of publicly establishing our equality, that he should himself voluntarily nominate me for election to the Royal Society as co-inventor of the Electric Telegraph, on my finding another scientific man of high standing to recommend me for my anatomical
216. attainments. He replied that there "would be difficulties," which required that he should first speak to some of his friends. In a word, our conversation ended with a distinct and positive assurance on his part that he would put me in a proper position, that is, in a position of perfect equality with himself; but he did not promise to do so in any particular way, I left the mode to his own judgment as I had done on previous occasions.
217. This irritating question having, as I thought, been thus satisfactorily settled, my feelings of dissatisfaction were laid aside, and the rest of our intercourse at that time was conducted with a degree of mutual cordiality not before evinced. I did not trouble myself at the appearance of the article in Chambers's Journal, or the Report of the Select Committee; both those unjust statements having been founded on previous and bygone matters, which I wished to dismiss entirely from my memory.

Other vexatious circumstances also passed over in the same way. I felt that my vindication was now undertaken by Professor Wheatstone, and that he would at least put me in a position of respectability. Things went on thus for nearly three months, till 218.

the appearance of the paragraph on the Brussels experiments. This was a fresh evil, originating subsequently to our interview in July. I was also at the moment in a very peculiar position. Proposals were pending with some friends of Mr. Wheatstone's, for a sale to them of a share in our patents, with the immediate view of forming a large company. I felt myself now peremptorily called 219.

upon to vindicate, without further delay, my connexion with the invention. I therefore addressed to Professor Wheatstone a letter, which he himself Cooke's Letter of 20 October 1840.

admits to be written with temper. I did not charge him with having caused the reports of which I complained, but only brought again and finally under his notice his obligation to correct the mistaken impression which (from whatever cause it had arisen) certainly existed, and was certainly injurious to me. I made use of the following expressions:—

“Allow me to add, that however your erroneous position may have originated, you yourself become responsible for it when you decline to recede from it. A continued neglect to contradict mis-statements which have been circulated in your favour, and by parties receiving their information personally from yourself, can only be construed as a voluntary retention and appropriation to yourself of what you 220.

221.
Wheatstone's
Letter of 26
October 1840.

- know, and have repeatedly admitted, to belong to another in common with you ; nor can it redound to the credit of your liberality, if you sanction by your silence even an unauthorized misapplication of your influence in the scientific world to repress and conceal the merits of a comparatively unknown colleague." In answer to my letter, I received Mr. Wheatstone's, which I have so often quoted. Here, for the first time, he openly maintains his ground, and vindicates to himself the sole invention of both forms of the Electric Telegraph ; yielding to me little more than "the whole merit of laying down the lines, and of overcoming all the practical difficulties attending that important operation ;" thus, in fact, confirming to any person reading the letter the very erroneous idea of my being scarcely, if at all, above the rank of his pecuniary agent and practical assistant ; admitting me, indeed, to be his partner, but only in the "commercial speculation,"
222. not in the invention. On the following day, I received a second letter granting, or rather demanding, the arbitration which I had called for in the alternative of my other claims not being fairly met ; and requiring (what I had not proposed or thought of) that the arbitration should be made binding by arbitration bonds, "and all the proper legal forms."
223. Approving of the terms he proposed, as likely to add weight to the award, I immediately closed with him ; and within 48 hours, the draft of the agreement of reference, prepared by my solicitor, was under the consideration of his.

One of my objections to the publication of the 224.
Brussels experiments was, that by circulating over
the Continent an idea that the Electric Telegraph
was Professor Wheatstone's sole invention, it tended
to deprive a supposed adverse claimant of the sup-
port of the government of any country in which
such an opinion was prevalent; and consequently
to render nugatory and useless my separate rights
in several continental countries which Mr. Wheat-
stone had agreed, by our partnership deed, to leave
open to me. Another circumstance, of a similar 225.
character, connected with Russia, has lately trans-
pired, and has been mentioned to him in a recent
letter.

Professor Wheatstone will himself admit that he 226.
has never, in his conversations with me, claimed
more than an equality of invention. Now in what
does my equality with him consist?—Is it in our
scientific discoveries or researches? No. Mr.
Wheatstone justly ascribes those discoveries and
researches solely to himself. Is it an equality in
the invention of instruments and other mechanical
contrivances? Assuredly not. In the exhibitions of
instruments, which Mr. Wheatstone describes as
“entirely his own experiments,” but which the
Parliamentary Report, Chambers's Journal, and
other periodicals in several countries concur in pro-
claiming to the world, upon his authority, as the
entire Electric Telegraph—surely there I am placed
on no equality. Or is it as projector and intro- 227.
ducer of a practical system of telegraphing by elec-

tricity, at a time when the idea of an Electric Telegraph had been treated for years rather as a subject for a lecture than as a thing capable of practical application ; as the practical projector and indefatigable worker-out of a comprehensive system, to which Professor Wheatstone's discoveries in science have been since applied, and on which his detached inventions have been engrafted in common with my own? No. He writes that to our first English patent, he "contributed" the Galvanometer Telegraph, while he had "no opinion whatever" of the "ingenious contrivance" contributed by me. He writes that in the subsequent development of the Galvanometer form, "he is indebted to no person whatever ; that it is, in all its parts, entirely and exclusively his own." He writes also, that his new instruments "are as original combinations as ever were put together ;" and that mine were "devised afterwards," upon the same principles, "with a full knowledge of all that he had done." He adds plainly, that "it is his Electric Telegraph, and not mine, that is in daily use." Here again, we stand on no equality. If then my acknowledged equality consists not in scientific discoveries, mechanical contrivances, or practical projection ; if little or nothing is added to the "merit of laying down the lines" but that of having produced, only to be "given up as hopeless," an "ingenious" and useless "contrivance ;" my supposed equality must have been a gratuitous gift on Mr. Wheatstone's part. But I appeal to all his scientific friends—I appeal to Pro-

fessor Daniell himself—whether they have received any notion of our equality from his own lips.

Professor Wheatstone lives surrounded by eminent scientific friends ; I live in strict retirement. While labouring for years against great difficulties to bring into general use an invention, which, from the first hour I thought of it, I have viewed in the light of a practical undertaking of national importance ; I could have acknowledged most gratefully the generous conduct that would have cheered me on in a truly arduous, and, at times, disheartening task. With a moderation which I feel the Arbitrators will appreciate, I from time to time appealed to Professor Wheatstone's justice and liberality not to damp my ardour by allowing erroneous reports, however favourable and gratifying to him, to pass current through the country. I have left to him the time and manner of correcting them : but he has disappointed all my pacific and friendly overtures, and he now answers my final appeal with an intimation that "I cannot bring forward one word he has ever spoken, or one line he has written, in which he has admitted my claim ;" concluding with a cold compliment on his remaining confidence in me, with regard to his pecuniary interests. 229.

Gentlemen, this is not an inquiry into the competing claims of two scientific men. You have undertaken to decide between a gentleman of the first eminence in the scientific world, deeply versed in all the knowledge and discoveries of others engaged in similar pursuits ; and one who, without pretend- 230.

ing to science—without aid from science—has struck out a path of his own, long open to but never pre-occupied by others ; who claims to have projected and introduced a practical invention promising to be highly important to his country. Your award in my favour, to the utmost extent of my claims, cannot detract anything from Professor Wheatstone's scientific reputation ; and the further I am removed from the support of the scientific world, the stronger is your moral obligation, as gentlemen and men of science, to afford an attentive hearing to my appeal to you for justice, and to allow no previously formed impressions, however strong, to influence your consideration of the evidence to be brought before you.

231—240.

The CASE of PROFESSOR CHARLES
WHEATSTONE in the ARBITRATION
between Himself and Mr. WILLIAM
FOTHERGILL COOKE.

THE subject of telegraphic communication has 241.
for a long series of years occupied my thoughts. 1823—1837.
When I made in 1823 the discovery that sounds of Professor
all kinds might be transmitted perfectly and power- Wheatstone's
fully through solid wires and rods, and might be researches, &c.,
re-produced in distant places, I thought that I had before his
an efficient and economical means of establishing a acquaintance
telegraphic (or rather a telephonic) communication with Mr. Cooke 242.
between two distant places. Experiments on a 243.
larger scale, however, showed me, that though for
short distances most perfect results were obtained,
yet that the sounds could not be efficiently trans-
mitted through very long lengths of wire. My ideas 244.
respecting establishing a communication of this kind
between two distant towns are stated in my Memoir
on the Transmission of Sound, published in the
Journal of the Royal Institution for 1831. I desire 245.
also to refer to an extract from Ackerman's Repo-
sitory for 1823, the year in which my experiments
were first made known.

246. I afterwards turned my attention to the employment of electricity as the communicating agent.
247. The suggestions and experiments of Cavallo, Reiser, Scemmering, Ronalds, Ampère and others had failed to produce any well-grounded belief in the
248. practicability of such an application. This want of confidence resulted from the imperfect knowledge then possessed respecting the velocity and other properties of electricity; some philosophers made it travel only a few miles per second, others considered it to be infinite: if the former were true, the consequences to be deduced from it would not leave much room for hope; but if the velocity could be proved to be very great, there would be
249. encouragement to proceed. I determined to investigate this point, and by means of some original expedients ascertained that electricity of high tension travelled through a copper wire with a rapidity not inferior to that of light through the planetary space, and I obtained abundant reasons for believing that electricity of all degrees of tension travelled
250. with the same velocity in the same medium. The insulated circuit I established for these experiments, enabled me to ascertain that magnetic needles might be deflected, water decomposed, induction sparks produced, &c., under properly arranged circumstances, through greater lengths of wire than
251. had ever yet been experimented upon. In the year 1836 I repeated these experiments with several miles of insulated wire, and I ascertained (which had never been done before) many of the conditions

But see 593 —
596; also 598.

necessary for the production of the various magnetic, chemical and mechanical effects in very long circuits. I also devised a variety of instruments by which telegraphic communication should be realized on these principles. 252.

It is impossible for me now to recall all the various contrivances which suggested themselves to me. I will merely mention a few, of which some evidence besides my own exists. 253. See 507.

1st, I proposed a telegraph with two wires, in which electric sparks and my revolving mirror were employed; at each station a break was to be made in the wire, so as to allow the discharge through the circuit to appear at the interval as a spark; behind this interval was to be placed a revolving mirror, or before it a revolving prism; so that when the discharges were, by a particular contrivance for making and breaking the circuit, caused to follow each other in such rapid succession as to appear at the interval but as a single spark, they were developed in the revolving mirror or prism, and their number and order rendered at once visible to the eye. By this means a great variety of essentially distinct signals might be presented in rapid succession. The revolving mirrors were not required to move at all accurately together; the only difference in the signals at the different stations would be, that the sparks constituting them would be spread more or less, but their number and order would remain the same. To illustrate these points, diagrams were drawn for my lectures in 1835 or 254.

1836; I have ~~not~~ continued these experiments, but the principles employed in them have been of great
 256. use to me in my most recent investigations. My
 rythmical telephone, invented last year, is but a
 modification of it, in which the strokes of a bell are
 substituted for the sparks, and the voltaic current
 for the electric discharge.

257. 2dly. I invented the apparatus for making and
 breaking the circuit, which I have since employed
 in my new instruments, described in the third
 patent, and which constitutes one of their most im-
 portant and indispensable parts. Mr. Kirby, a
 workman now in Mr. Cooke's employ, made the
 instrument, which I shall exhibit to the Arbitrators,
 in 1835 or 1836. All this occurred before a similar
 contrivance was adopted on the Continent for
 electro-magnetic machines.

258. 3dly. I proposed to substitute a magnetic needle
 in a multiplier for the electrometer in Ronalds'
 Telegraph. This instrument had a revolving dial,
 with letters upon it, and with some slight modifica-
 tions which I have since made, is represented in
 my drawings, which will be submitted to the Arbi-
 trators. This telegraph will, I am convinced, still
 prove highly useful under certain circumstances.

259. 4thly. I invented the commutating principle by
 which a few wires were converted into a number of
 circuits, which forms the most essential and dis-
 tinguishing feature of my present magnetic needle
 telegraph. The key-board or communicator which
 260. I made before I knew Mr. Cooke is the same as I

now employ, and as presented in fig. H., sheet I. of the drawings of the specification of the first patent: if necessary, the workman who made it for me can be brought forward.

5thly. I proposed to employ electro-magnetic attraction for the purpose of ringing an alarum. Finding from experiment that I could not obtain any attractive effect at a distance in my long circuit from any of the electro-magnets I tried, I then proposed to employ the adhesive force; the armature was to be brought to the magnet by an independent piece of mechanism, and allowed to fall on the detent of the alarum whenever the circuit was broken, as represented in my drawings. Mr. Cooke will recollect that I mentioned these things to him before I knew any thing he had done.

Some time before Mr. Cooke introduced himself to me, I considered my experiments to be sufficiently matured to enable me to undertake some important practical result. I informed Mr. Fox, an engineer of the London and Birmingham Railway, of my expectations, and told him of my willingness to superintend the establishment of an Electric Telegraph on that railway. I had also made arrangements for trying an experiment across the Thames, from my lecture-room to the opposite shore. Mr. Enderby kindly undertook to prepare the insulating rope containing the wires, and to obtain permission from Mr. Walker to carry the other termination to his shot-tower. After many

261.

Answer, 615—
623.

262.

Answer, 621.

263.

Professor
Wheatstone's
"practical ad-
vances" before
his acquaint-
ance with
Mr. Cooke.

Answer, 516—

545, and 754.

264.

265.

Answer, 535—

545.

266.
Answer, 543—
545.

experiments had been made with the rope, and the permission granted, I relinquished the experiment; because after my connexion with Mr. Cooke, it was necessary to divert the funds I had destined for this purpose to other uses. What I have above stated is sufficient to show that I had paid great attention to the subject of telegraphic communication by means of electricity, and had made important practical advances long before I had any acquaintance with, or had ever heard of Mr. Cooke. My experiments had also been announced in print in the Magazine of Popular Science, for March 1837.

267.
Answer, 576.

268.
February and
March 1837.
First inter-
views between
Mr. Cooke and
Professor
Wheatstone.
Answer, 565—
585, and 755.

I believe, but am not quite sure, that it was on the 1st of March 1837, that Mr. Cooke introduced himself to me. He told me that he had applied to Dr- Faraday and Dr. Roget, for some information relative to a subject on which he was engaged, and that they had referred him to me, as having the means of answering his inquiries; he gave me no clue as to the purpose he had in hand. I replied, that he was welcome to any information I could give him, and that the experiments I had been making for some time relative to employing electric currents, for the purpose of telegraphic communication, would enable me to give him much of the information he required. At our next interview, which was very shortly after, he told me that he also was working at an Electrical Telegraph, and that the questions he had previously put to me related to this subject; but he said nothing respect-

269.

270.

ing the nature of his experiments. It was on this occasion, I believe, that I showed him my permutating key-board, and mentioned to him my proposal for ringing an alarum by means of an electro-magnet, with various other things, and invited him to the College to see my experiments in action; all this occurred before Mr. Cooke communicated to me any thing he had done. At length Mr. Cooke showed me some of his drawings and models, and though I could not fully comprehend the full scope of them at the time, I saw and understood enough to assure me that his instrument was a massive complicated piece of machinery, intended to be set in action by the attractive power of an electro-magnet. On seeing this, and relying on my former experience, I at once told Mr. Cooke that it would not and could not act as a telegraph, because sufficient attractive power could not be imparted to an electro-magnet interposed in a long circuit; and to convince him of the truth of this assertion, I invited him to King's College, to see the repetition of the experiments on which my conclusion was founded. He came, and after seeing a variety of voltaic magnets, which even with powerful batteries exhibited only slight adhesive attraction, he expressed his disappointment in these words, which I well remember, "Here is two years' labour wasted."

Mr. Cooke informed me that his principal scientific knowledge had been derived from Mrs. Somerville's "Connexion of the Physical Sciences." He

Answer, 580.

Answer, 580—
581.
271.272.
Answer, 582.273.
Answer, 583—
584.274.
Answer, 508.

275.
Cooke's Case,
13.

276.
Answer, 602—
614.

Cooke's Case,
54, 18, 19.
See also, 650—
651.

Answer, 743.

told me also that the idea of his instrument had occurred to him partly from the proposed application of electro-magnetism as a motive power and partly from the mechanism of a musical box. Mr. Cooke had, moreover, previously heard of Electric Telegraphs having been attempted, for in his letter of April 25, 1837 (now in my possession), he speaks of "the simple Telegraph of Professor Möncke of Heidelberg, which he had seen when he was in Germany." I understand from Professor Jacobi that Baron Schelling, of St. Petersburg, exhibited at the meeting of German Naturalists, held at Bonn in 1835, his Magnetic Needle Telegraph, one of the most perfect arrangements made before my experiments, and which appears from Professor Jacobi's description to be almost identical with an apparatus made by Mr. Cooke, subsequent to the invention of my Magnetic Needle Telegraph.

277. Mr. Cooke, in his letter of October 20, 1840, states "that he alone had succeeded in reducing to practical usefulness the Electric Telegraph at the time he sought my assistance; that he alone had projected and originated it as a work of practical utility;" and that "my scientific researches were unapplied." To these statements I answer, that Mr. Cooke's instrument, which he called an Electrical Telegraph, had never been practically applied, and was incapable of being so; while, on the contrary, the instruments I had proposed were all founded on principles which I had previously proved by decisive experiments would produce the required effects at

great distances. My researches were not merely theoretical, but were eminently of a practical nature.

With regard to Mr. Cooke's invention (which I shall hereafter call, as he himself designates it, his Chronometric instrument), so far from its being "practically useful," he has never during my whole acquaintance with him shown it to me in action, even in a short circuit; it was, after it had been intended to be inserted in our first patent, omitted as useless, and Mr. Cooke, when he took out the second patent himself, did not even then think it of sufficient importance to mention it there. I do not think he would again have brought it forward, had it not been for the purpose of supporting an imaginary resemblance between it and some of my new instruments.

Mr. Cooke's intention was, as he told me in an early stage of our acquaintance, to take out a patent for his invention; mine was, when I had finished my experiments, to publish the results, and then allow any person to carry them into practical effect. When Mr. Cooke found that his instrument was inapplicable to the purpose proposed, and that my researches were more likely to be practically useful, he proposed a partnership, and that we should take out a joint patent; the proposition did not proceed from me, and the sole reason of my acquiescing in the arrangement was, that Mr. Cooke appeared to me to possess the zeal, ability and perseverance necessary to make the thing succeed as a commercial enterprise, and expressed his intention of de-

278.

Answer, 740.

279.

Cooke's Case,
193.

280.

281.

Answer, 550—
559.

282.

Answer, 550—
559.

283. voting his whole time and energies to it. I felt confident of overcoming myself all the scientific and mechanical difficulties for the subject; but neither my occupations nor my inclination qualified me for the part Mr. Cooke promised to perform. At first I strongly objected to this partnership; I urged, that by associating myself with another person I should be putting him in a position to claim the merit of what I had done; whereas standing alone I could, by publishing, obtain the credit of my own researches, without other persons having the right to interfere. Mr. Cooke replied that my fears were perfectly groundless; that no difference could or should arise between us on this account; that I might publish my experiments when and in what manner I pleased: he said that he was not seeking a scientific reputation, his sole object being "to make money by it"—these were the very words he employed. I need not point out the inconsistency of Mr. Cooke's present claims with this declaration; since, not content with the merit which is justly due to him for his own inventions, and for laying down the lines, he now by the mode in which he shapes his claims wishes to deprive me of the chief merit of my own discoveries and inventions, in which he has not borne the slightest share.
284. Cooke's Case, 58—66.
285. Ibid.
286. Answer, 550; and see Cooke's Pamphlet of July 1836.
287. February 1837—November 1839. Professor Wheatstone's experiments Thus far my statement is confined to what I had effected before I became acquainted with Mr. Cooke. I will now proceed to give an account of the experiments I made since my acquaintance with Mr.

Cooke, and before the announcement to him of my new instruments, i.e. between February 1837 and November 1839.

since his acquaintance with Mr. Cooke
Answer, 586—601.

The Magnetic Needle Telegraph, as it appears in its most perfect state in the lecture-room of the College, is to all intents and purposes entirely and exclusively my own invention. The original suggestion of Ampère was all that I borrowed in it.

288.
651, also 650.

The important principle of my permutating key-board, by which a few wires could be converted

289.
Answer, 590.

into a great number of circuits, the indication of the characters by the convergence of the needles, the employment of vertical astatic needles, the limitation of the motion of the needles by fixed stops, so that they should point accurately to the characters, were all points which I had never heard of before, and which I believe no person can contest with me. But the most important point of all was my application of the theory of Ohm to telegraphic circuits, which enabled me to ascertain the best proportions between the length, thickness, &c. of the multiplying coils and the other resistances in the circuit, and to determine the number and size of the elements of the battery to produce the maximum effect. With this law and its applications no persons who had before occupied themselves with experiments relating to Electric Telegraphs had been acquainted.

290.
Answer, 592—596.

The apparatus, as fixed in the lecture-room, is complete in itself; but I have invented a variety of modifications to suit especial purposes, which are

291.

equally original. I will merely particularize them, referring for further details to the instruments themselves, or the drawings.

292.
Answer, 654.

1st. A different key-board or communicator, in which the keys are the same in number as the characters on the signal board, and have precisely the same arrangement.

293.
Cooke's Case,
55.

2d. The omission of one needle from the signal board, the number of communicating wires remaining the same as before. By this arrangement some of the characters are indicated by a single needle, and others by the convergence of two needles. The advantage of this modification is portability; the disadvantages, loss of symmetry between the key-board and signal-board, and diminution of the number of compound signals.

294.
Tables, Part
M. Principle
III.

3rd. The employment of the last-mentioned signal board, with two blank wires, in which relay batteries were proposed to be placed at appropriate distances.

295. 4th. A new arrangement of the signal board, key-board, and needles, as shown in the drawings. In this arrangement the keys are concentric with the signal board.

296.
Answer, 655—
676.

5th. A modification of the apparatus intended for an intermediate station, by which a message may be sent in either direction as required.

297.
As to the
Alarum.
Answer, 615—
647, and 756.

I now come to the history of my investigations and their results with regard to the Alarum.

A means of calling the attention of the observer

to the telegraphic apparatus previous to a communication being made is obviously indispensable. 298.
 Ronalds, in 1823, for this purpose, exploded a Volta's pistol by means of the electric spark, as Cavallo (Treatise on Electricity, 1795, vol. iii. p. 290) had long before proposed. Weber and Gauss in 1835 caused a heavy magnetic needle to strike a bell; and Baron Schelling, of St. Petersburg, in 1833, caused a small watch alarum to be discharged by a motion produced by the deflection of a magnetic needle.

When I endeavoured to ascertain how a bell 299.
 might be more efficiently rung, the attractive power obtained by temporarily magnetizing soft iron first suggested itself to me. The experiments I made 300.
 with the long circuit at King's College, however, Answer, 621—623.
 led me to conclude that the attraction of a piece of iron by an electro-magnet could not be made available in circuits of very great length, and therefore I had no hopes of being able to discharge an alarum by this means. But having observed that a piece 301.
 of iron brought in contact with an electro-magnet Answer, 617.
 in action would remain adhering to it, though it would not be attracted through any sensible distance, I next proposed to bring, by an independent piece of machinery, a piece of iron in contact with the electro-magnet in action; so that when the current ceased, the piece of iron should fall on the detent of an alarum and discharge it, immediately after which it should be again raised by the machinery. This plan is represented in my drawings; 302.
 Answer, 617.

and the principle employed in its construction has suggested to me some of the most valuable applications I have since made.

303. Before Mr. Cooke had given me the slightest
 Answer, 577—
 580. intimation of the nature of his experiments, and before I had any knowledge that he proposed to employ an electro-magnet in his instrument, I mentioned to him my ideas above stated respecting an alarum to be sounded by means of an electro-magnet.

304. I was the first to propose an independent alarum,
 Answer, 624—
 629. acted upon by an electro-magnet, suited for working with my telegraph. In consequence of finding some difficulty in procuring a bell alarum ready made for the experiment, I applied an electro-magnet to the detent of a musical box, which answered the same purpose. The only alarum Mr. Cooke proposed to me before this was a bell, to be struck by means of one of the pins of the barrel of his chronometric instrument.

305. Having convinced myself that it was hopeless to
 Answer, 631—
 634. expect to ring an alarum by the direct action of the electric current through a circuit of great length on an electro-magnet as ordinarily constructed, I began to think whether the effect required might

307. not be produced in an indirect manner. It occurred to me that the difficulty would be overcome, if a short circuit, in which the electro-magnet of the alarum, and a rather powerful electro-meter should be interposed, could be completed and broken at will by some action governed by the

current in the long circuit. On mentioning this 308.
 idea to Mr. Cooke, but without telling him the
 contrivance I proposed to employ, he said there
 were two means of accomplishing the object. A 309.
 few evenings afterwards I showed him at the Col- Answer, 635—
 lege a galvanometer I had had altered to effect this 639.
 purpose, and he on the same evening spoke to me of
 two plans he also had; but as his ideas on the sub-
 ject were then immature and vague, I could not fully
 comprehend them. Mr. Cooke's letter of April 25, 310.
 1837 (to be produced), acknowledges my priority Answer, 636—
 regarding the general idea, and my having made 639.
 the first experiment, but claims for himself an in-
 dependent originality. None of the plans men- 311.
 tioned in this letter, however, succeeded whether Answer, 640—
 suggested by him or myself; and it was not until 643.
 afterwards, when it occurred to me to employ a
 needle vertically suspended with a transverse wire,
 one end being always plunged in a mercury cup,
 whilst the other was alternately plunged in and
 raised out of another cup of mercury, as represented
 in my drawings, that the purpose was completely
 accomplished. The modification, which is ingeni- 312.
 ous, but altogether unessential, represented in
 figure S, sheet II. of the drawings to the specifica-
 tion of the first patent, was made by Mr. Cooke.
 A different mode of connecting the secondary cir- 313.
 cuit, by means of the decomposition of water, which Answer, 644.
 is represented in figure Q, sheet II. of the first
 patent, was wholly my invention.

These methods of completing the secondary cir- 314.
 Answer, 645.

315.
Answer, 646,
647.

cuit have lost nearly all their importance, and are scarcely worth contending about, since my discovery that electro-magnets may be so constructed as to produce the required effects, by means of the direct current, even in very long circuits. Previously, however, to this discovery it appeared to be of great consequence to both of us; to me, as the means of ringing the alarum, connected with my telegraph; to Mr. Cooke, as the only means of enabling him to work his instrument, if its other imperfections could be got over.

316.
Professor
Wheatstone's
charges
against Mr.
Cooke.
Answer, 648—
706, 757, 758.

During my connexion with Mr. Cooke, he has not to my knowledge employed himself in inventing any thing new or in making any real improvements on what I have done, but has confined himself to closely following my steps, making mechanical alterations in what I have suggested, and complicating instead of simplifying my arrangements. I am unwilling to ascribe motives to him for so doing, and I must leave the facts to speak for themselves. I will state a few instances.

317.
Answer, 649—
651.

After I had succeeded in perfecting my Magnetic Needle Telegraph, and he had despaired of his chronometric instrument, instead of immediately adopting mine, he went to considerable expense in constructing a Magnetic Needle Telegraph, which did not advance the subject beyond what had been

318.
Answer, 652—
654.

previously done on the Continent. Compelled to acknowledge the superiority of my invention and to relinquish his own imperfect instrument, he set

himself to modify my permutating key-board, and without changing the principle he made a complicated mechanical alteration, which also he was obliged to abandon. For instruments at intermediate stations it is convenient to have a means of communicating in either direction at pleasure, and this being a matter of mechanical detail, there are many means of effecting it. I proposed a simple and efficient plan, represented in the diagram which I submitted to Mr. Cooke at the time the experiments were being made on the London and Birmingham line; when, however, some time after, the thing was actually required on the Great Western line, without consulting me, Mr. Cooke adopted another arrangement which possesses no advantage over mine, while the principle remains necessarily the same. The intermediate apparatus was merely alluded to in our first patent; in the second patent, which was taken out by Mr. Cooke separately because I objected to it as unnecessary, he has described the arrangement he adopted. By sinking my proposal, and putting forward only his own, a person ignorant of the facts would be led to the conclusion that the contrivance for the intermediate apparatus was an original idea of his, contrary to the fact.

319.

Answer, 655—
676, and 758.

Answer, 663.

Answer, 664—
673.

320.

Answer, 669—
673.

321.

Answer, 660—
673.

322.

Answer, 677—
706, and 757.

The case, however, in which I considered Mr. Cooke acted with the greatest disregard of my rights and feelings, was the following: As I have said before, the Magnetic needle Telegraph, with permutating circuits and characters indicated by

- the convergence of the needles, is an invention exclusively and entirely my own, and rendered by me complete in all its details. This was emphatically "the Telegraph," and if any person had asked who was its inventor, my name alone could be mentioned. Yet Mr. Cooke was, it appears, unwilling that this merit should be ascribed solely to me; and with the view, as I am compelled, though reluctantly, to believe, of justifying the association of his name with mine on the instruments in question, he made a different disposition of the keys, but one in which the simplicity and symmetry of my arrangement was destroyed, while no advantage whatever was obtained. This done, he placed his name first on all the instruments, giving the erroneous impression to the visitors of the railway, that he had not only a share, but the most important share, in their invention. What I conceive justifies my view of this transaction is, that though by an express stipulation in our agreement, I should have been consulted on any proposed modifications in the instruments, and possessed the right of objecting to them; my opinion was never asked on the subject, and all the instruments for the railway were finished before I knew that any alterations were contemplated. I expressed my strong disapproval of these alterations; but as great expense had been incurred, I could do no more. When I remonstrated with Mr. Cooke on his placing his name prominently first on my instruments, he promised that the cause of complaint should be re-
323. See 494.
324. Answer, 687, 688.
325. Answer, 687—688.
326. Answer, 689, 690.
- Answer, 695.
327. Answer, 695.
328. Answer, 697.

moved; but he said that as it would not look well to have the change made all at once, he would, when a new instrument was made, substitute it for the one at Paddington, and afterwards do the same with the others. I was satisfied with these promises; but the substitutions had never been made, and the instruments since placed on the Blackwall Railway are on the same construction, and have also Mr. Cooke's name placed first.

Mr. Cooke's arrangements with the Railway Directors have enabled him to try all the experiments, and make all the instruments he wished; and I have often regretted that he should have wasted so much money in trying to do, in a different manner, what I had already satisfactorily effected, when so much remained to be done in original invention and discovery. From my own resources alone, unassisted in the slightest degree by Mr. Cooke, I have defrayed the expenses of all I have added to the joint-stock; and had I possessed the means which were put in his power, I should have accomplished far more.

In a letter, dated October 26 1840, and addressed by me to Mr. Cooke, I have stated at length the reasons that induced me, instead of communicating to Mr. Cooke every improvement and useful suggestion as it occurred to my mind, as I had hitherto been in the habit of doing, to interfere with him in future as little as possible, to carry out my future investigations alone, and to inform him

329.

Answer, 697—706.

330.

Cooke's Case, 80.

331.

Ibid. 98

332.

1839.

Professor Wheatstone's new instruments and separate privileges.

Cooke's Case, 123—125.

333. only of the final results when obtained. After this resolution had been taken, I commenced a series of researches on the laws of electro-magnets, and was
 Ibid. 95—97. fortunate enough to discover the conditions which had not hitherto been made the subject of philosophical inquiry, by which effects could be produced at great distances. This rendered electro-magnetic attraction, for the first time, applicable in an immediate manner to telegraphic purposes. I then proceeded to inquire how the principles I had ascertained could be best practically applied. The
 334. result was a variety of new instruments and apparatus, the greater part of which originated entirely with myself, while in others I availed myself of principles which the previous discoveries of others enabled me to do.
 Ibid. 95.
 Also, 103, 104.
335. I can perfectly recall to mind the combination of ideas which immediately, when this important point was obtained, suggested to me the simplest and most
 336. elementary form of my new telegraph. Several years before, when I was engaged in optical researches, it occurred to me that if, instead of causing a disc to revolve with a continuous motion, it could be rapidly moved by equidistant jerks, so as to make a certain number of instantaneous stoppages during each revolution; a piece of money placed at the circumference of this disc, might, during the motion, be apparently multiplied and the same number seen as there were stoppages in each revolution. I could not at that time succeed in this experiment, and the most experi-

enced clock-makers and machinists I consulted, told me it was hopeless to endeavour to stop a disc in such rapid motion with regularity. For a time I dropped the subject; but when Plateau's phantoscope was attracting public attention, I saw that my proposed instrument would serve to exhibit this phenomenon to a number of persons at the same time; and as so rapid a motion was not required in this case, my experiment was more likely to succeed. I therefore went to some expense in constructing instruments, and found that the effect was more perfect as the machinery and disc to be carried were lighter.

When I recalled this idea last year on the occasion of the telegraph, it occurred to me, that the interrupting wheel I had invented in 1835 or 1836 would perfectly answer the purpose of governing these periodical cessations of motion; it did so, and I have made no change in this principle since my new instruments were first made. 337.

Thus my new electro-magnet, my disc revolving with an interrupted rotatory motion, and my rheotome or interrupted wheel, combined together, constitute the whole of my new telegraph in its simplest form. 338.

The pervading principle of my new instruments, which distinguish them essentially from every thing effected before, is this, that the various signals are determined by different regular productions or interruptions of the current, a different number of productions or interruptions giving rise to a dif- 339.

Cooke's Case,
36, 37, and
102.

Answer, 738. ferent signal. This is the essential principle which cannot be omitted in any of my instruments; but the electro-magnet may be replaced by a magnetic needle within a multiplier, or by an electro-dynamic coil and a permanent magnet, and a printing apparatus may be substituted for the dial with the letters.

340. The principle of Mr. Cooke's proposed instrument was that of determining the signals by different durations of a single continuous current, a different duration giving rise to a different signal. This rendered it indispensable that it should be provided with a maintaining and regulating power, and that the revolutions of all the instruments placed in the same circuit should be made in exactly the same time. These instruments were, therefore, what Mr. Cooke very properly called them, chronometric instruments (see his letters), a designation totally inapplicable to mine, which are quite independent of any adjustment as to time.

Ibid. 738.

Cooke's Case, 36.

341. Mr. Ronalds' were also chronometric instruments, but they differed from Mr. Cooke's in principle by this; his chronometric instruments were allowed to continue in uninterrupted motion, and the transit of the character was indicated by the motion of an electrometer; whereas in Mr. Cooke's instrument, the instruments were to be simultaneously started and stopped by the production and cessation of the current. Different as these principles are from each other, there is yet more resemblance between Mr. Cooke's and Mr. Ronalds', than between Mr. Cooke's and mine.

Answer, 738.

No two instruments, considered in their complete arrangements, can be more dissimilar than mine and Mr. Cooke's. There is not one part original with him that is included in my instrument. It is true, that in his and in some of mine, a voltaic battery, an electro-magnet, and a revolving dial are introduced. The electro-magnet had been long before applied to move machinery, and Mr. Cooke did nothing to make it act at greater distances than had before been attempted, as I have done. I had, myself, before I knew Mr. Cooke, proposed to employ the electro-magnet for telegraphic purposes, and Mr. Morse of New York, had also, independently of both of us, employed it for the same end, The employment of a revolving dial suggested itself to Mr. Ronalds long before. The way in which these elements are combined together in our two instruments, have not the slightest resemblance. I will leave for the present out of the question, that mine are valuable and acting instruments, fulfilling all the purposes for which they were intended; while Mr. Cooke's was a mere abortive attempt, an ingenious but complicated piece of mechanism, constructed without adequate knowledge of scientific principles.

The demand that Mr. Cooke now makes, that I should publicly acknowledge that my new instruments are mere improvements on his abandoned project, is unreasonable and unjust. Had I taken, which I had not done, any original combinations which he had been the first to suggest, and in-

342
Cooke's Case,
101.

343.

344.
Answer, 717.

345.
346.
Cooke's Case,
101.

Cooke's Case,
45.
Answer, 707—
710.

347.

Cooke's Case,
99.
See also, 716.

348.

Answer, 716. produced them in any of my new instruments, all that could have been expected of me would have been to acknowledge that he had preceded me in these points, and to refer to his instrument from which they were taken. Wherever I have borrowed an idea from Ohm, Gaüss, Steinheil, or any other person, I have, and shall always be ready to acknowledge it. Mr. Cooke will, no doubt, publish an account of his instrument, and the public then will be able to judge of its value, and of how far it has suggested the more recent improvements.

350. I am fortunately enabled to show, from documents
 Answer, 718— in Mr. Cooke's own writing, that, for some time
 721. after I communicated to him my new inventions, he had no idea of putting forth the claims he has since done, and that he did not himself then consider that my instruments were founded upon his. In his
 351. letter of December 11, 1839 (now in my possession),
 Answer, 721. he expresses his wish to introduce into the patent I was about to take out, a principle, founded, as he says, on his instrument of 1836; but he makes no allusion whatever to my having borrowed any thoughts of his; and in the same letter he confirms his previous consent, that the new instruments I had shown him should be called my new instruments, and that my name alone should be engraven upon them. What could be a more distinct acknowledgment from him that these were my exclusive inventions, than his agreeing that my name alone should

appear on those instruments, though in a pecuniary point of view they were still to remain our joint property? In a subsequent letter, dated December 16, 1839 (also in my possession), he asks me to allow him to make the instruments for the railroads; but in this case also, he adds, my name should still alone be placed on the instruments. 353.
Answer, 720.

And yet after these full and distinct admissions, confirmed also by the draft of our proposed agreement, prepared by his own solicitor, he now requires me to contradict what he has before personally and legally admitted. He first allows, in the fullest manner, my right of publishing my name as sole inventor of my new instruments, and then complains of me for permitting other persons to say they are mine. In my last Belgian patent I have described only my own new instruments. All the matter introduced by Mr. Cooke in our last English patent is there omitted; it appears that during my absence in Belgium, some paragraphs which I have not seen appeared in the English papers, noticing the experiments I was making there. Mr. Cooke feels himself aggrieved, that the editors of those papers did not mention his name in conjunction with mine as the joint inventor of these new instruments, which he had already, as I have above stated, admitted in the amplest manner to be exclusively my own. 354.

355.
Answer, 719.

356.

357.
Cooke's Case,
196, 197.
See also 218.
Answer, 719.

I shall now take into consideration another demand which appears to me of a most unreasonable 358.
Mr. Cooke's
new instru-
ments.

Answer, 722— character, and which Mr. Cooke has advanced in
728, and 761.

his letter of October 20th 1840, namely, that I should acknowledge the instrument he has inserted in the last patent to be not only founded on his old instrument, but to have been invented and worked

359. out by him independently of me. I shall be able, and I hope in the most satisfactory manner, to prove by documents in his own hand writing that

360. this demand is unreasonable. When I imparted to Mr. Cooke my new inventions, he said nothing about any improvements in which he was himself then engaged, and he at that time consented that the proposed new patent should be taken out in my

Answer, 719. name alone, and that the preparation of the specification should be left entirely to me. But in his
361.

letter of December 11th 1839, written a week or two after our meeting, he expresses a wish to introduce a principle in the new patent I was about to take out, founded, as he says, on his chronometric instrument of 1836; but acknowledging that the most essential parts were taken from my new instrument. He says, "If entered in the

Answer, 728
and 721.

362.
Answer, 721.

patent, your name will of course take the lead as the inventor of so many valuable improvements, and indeed of those very points which render the principle alluded to above of practical value."

363.
Answer, 728
and 721.

In the drawing which accompanied this letter, and which will be submitted to the inspection of the Arbitrators, he has represented the barrel and keys of his old chronometric instrument, and has marked certain other parts of his sketch as being

my invention. After seeing these documents the Arbitrators must decide upon the truth or untruth of the statement, that Mr. Cooke worked out this and his subsequent instrument from his own ideas independently of me. 364.
Answer, 761.

In the instrument represented in the third sheet of the new patent, Mr. Cooke has rejected the part founded on his chronometric instrument which was 365.
Cooke's Case,
104, also 111.

represented in his original sketch, and has substituted for it a slight modification of my communicator which involves my essential principle. By this change it has lost all resemblance to his former instrument, and has become a mere modification of mine. Mr. Cooke has adopted in this instrument no less than six points which originated with myself, and which I have enumerated in my letter of October 26th 1840. I 366.
Answer, 721.

cannot consider any of the alterations made by Mr. Cooke to be improvements. Instead of breaking and making the circuit simply by the disc of the communicator itself, he converts this into 367.
Cooke's Case,
110.

a cogged wheel which moves a smaller wheel, by which the circuit is to be completed or broken. Instead of moving the disc with the characters, he moves a hand while the disc remains stationary, thus losing the advantage of the fixed stop. 368.
Ibid. 111, 112,

Instead of one magnet and two communicating wires, he employs two magnets and three communicating wires. 369.
Ibid. 105—107

For all distances at which my instruments will act, it is obvious that no advantage would be obtained by these complicated and expensive ar- 370.

rangements. Mr. Cooke, however, thinks, that by employing the adhesive principle he could make the instruments act at greater distances than mine; but he has completely overlooked the fact, that
 Cooke's Case, 5. relay battery circuits of three wires cannot be employed in imperfectly insulated lines, which all lines on a railway are.

371. It may be necessary to say a word or two on the adhesive principle, which, though I have not employed it in any of my telegraphic instruments, I had originally proposed for my alarum. That Mr. Cooke had not employed it in his chronometric instrument is evident; for in his drawing and letter
 Tables, Part M of December 11th 1839, he has stated the circuit Principle III. with relay batteries to be an original conception of mine, and it is obvious that the adhesive principle cannot be applied in a telegraphic instrument without it.

372. In consequence of the insertion of Mr. Cooke's
 Answer, 760. instrument, to save time and unnecessary expense, I withdrew several things which I had originally intended to include in the specification of the third patent: among these were the relay batteries applied to my instruments, and an instrument with three wires and a double magnet, which I had invented before Mr. Cooke made his.

373. I will not lengthen this statement with an account of the numerous researches I have made on the laws of electrical currents, with a special reference to the subject of telegraphic communication.
 Professor Wheatstone's scientific researches.

But I am ready to show the apparatus and explain the results to the Arbitrators. To these researches, ^{Cooke's Case, 2.}
 Mr. Cooke cannot advance the slightest claim, for ^{374.}
 he is even now unacquainted with them; and yet ^{Answer, 505.}
 the instruments I have invented, particularly the last, are in their essential principles mere applications of these laws, and could have had no existence without that previous knowledge had been obtained. In the accounts I hereafter intend to publish, it will be impossible to separate my experimental researches on the laws of electricity from the inventions which resulted from them; and it would certainly be a strange anomaly if Mr. Cooke were to be allowed to call himself the joint inventor of my instruments, and yet that I should retain the credit of having worked out the laws which suggested them. But it would be a matter of still higher injustice if the public should be led to suppose that Mr. Cooke's share in the development of the new instruments is equal to mine, when he is totally ignorant of the investigations which led to them, and founds his only claim in a disputed resemblance of some parts of one of my instruments to other parts in an instrument made by him several years ago. ^{Cooke's Case, 115. Answer, 494. 375. Answer, 584. 376. Cooke's Case, 101—104; and see 716.}

From the preceding statement, when supported by the evidence in my possession, I submit that the following propositions necessarily result; viz. ^{377. Professor Wheatstone's conclusions.}

1st. That my experiments, previous to my acquaintance with Mr. Cooke, prepared the way for ^{378. Answer, 743—745.}

the practical realization of an Electric Telegraph more than any experiments that had hitherto been made.

379. 2d. That Mr. Cooke's efforts, before he became
 Answer, 737—acquainted with me, were limited to constructing a
 741. machine much less capable of being applied to the purpose intended than other inventions previously made, and which machine was never practically employed, and which was, after his association with me, abandoned as hopeless, and omitted from the patent, though it was originally intended to form part of it.

380. 3d. That the first Electric Telegraph which fully
 Answer, 743; succeeded was solely my invention; viz. the Mag-
 also 650, 651. netic Needle Telegraph, in which a few wires could be converted into numerous circuits, and the characters were indicated by the convergence of needles.

381. 4th. That the changes made by Mr. Cooke in
 Answer, 746; this instrument were unnecessary or useless, it being
 also 651. perfect without them.

382. 5th. That the alarum, acting by an electro-mag-
 Answer, 756. net, and the secondary circuit to be completed or broken by some action of the primary circuit, were perfectly independent inventions of mine, and were mentioned by me to Mr. Cooke before he announced to me that the same ideas had occurred to him.

383. 6th. That all the effectual means of completing
 Answer, 630—and breaking the secondary circuit have been con-
 645. trived by me.

384. 7th. That there is not the slightest ground for

considering any of my new instruments to be improvements on Mr. Cooke's abandoned instrument. They are exclusively my own inventions; as Mr. Cooke has already admitted by agreeing that my name alone should be used upon them. Answer, 759.
Answer, 719.

8th. That the instrument represented in the third sheet of the drawings of the new patent is not distinct from mine, nor was it worked out by Mr. Cooke separately, but was subsequently made with a full knowledge of what I had done, and introduces a variety of principles first suggested and applied by me. 385.
Answer, 759.

AS TO MY EXCLUSIVE RIGHT.

THE exclusive right for the United Kingdom which I claim in all the instruments and principles invented and made known by me since the date of the specification of our first patent, consists in the following particulars. I found this claim on Mr. Cooke's verbal and written promises to me, and on the draft of the proposed agreement forwarded to me by Mr. Cooke's solicitor, in the month of December 1839. 386.
Professor Wheatstone's separate claims.
See 762.
Cooke's Case 82—95.

1st. That my name alone shall appear as the inventor of these instruments, whether they be intended for the use of railways or for any other purpose. In Mr. Cooke's letter of December 11th 1839, he admits this right; but lest it should be objected that my name was to be allowed to be placed on these instruments only as the maker, not as the inventor, I will refer to a subsequent letter of his, 387.

dated December 16th 1839, in which he wishes me to allow him to manufacture them for railways. On this occasion he says, "Your name to be on all your instruments, whether made by you or me, at your option, will still appear in the agreement."

388. 2dly. That I shall have the sole right of manufacturing my new instruments, and the whole of the profits arising therefrom. Mr. Cooke admits this right in both of the above-mentioned letters.

Answer, 693—696. The principal reason for my claiming it was, as I told Mr. Cooke at the time, to prevent in future alterations being made by him or others in my instruments without consulting me, and against my wishes, as had previously been done in the case of the instruments on the Great Western Railway.

389. 3dly. That I shall have the exclusive right of employing my new instruments on lines not exceeding a mile in length. At first, Mr. Cooke allowed this without restriction. He afterwards proposed that docks, harbours, arsenals, fortifications and railway termini should be excluded from my separate right, to which I consented. But I have not agreed that mines should be excluded, nor that I should be prevented from joining two separate properties within the distance of a mile, though Mr. Cooke insists upon these restrictions. To Mr. Cooke's proposal (in his letter of December 15th 1839) of making him a party in the licences, or indeed, of requiring licences at all, I have always expressed the strongest objection, as uselessly fettering me, and being no protection to our joint inte-

rests, and as not having been contemplated in our original verbal agreement.

I shall bring forward the memorandum of agreement which I read to Mr. Cooke in our first interview on the subject, and also another memorandum which I subsequently showed him. The erasure of Claim 7, in the latter, was made at Mr. Cooke's suggestion; because Mr. Cooke said he would give me an opportunity of meeting a Mr. Lancaster, and talking over the matter with him. These documents show the grounds upon which I required these exclusive privileges, and which I have put forth at fuller length in my letter of October 26, 1840. 390.

Had the third patent been taken out in my own name alone, and had it contained only what I had designed to insert, according to my intention and Mr. Cooke's original verbal agreement, the difficulty would have been avoided. But the insertion by Mr. Cooke of the instrument represented in sheet III. may give rise to a doubt whether, notwithstanding my exclusive rights, licences might not be given by the joint proprietors for these instruments for lines under a mile in length. But I contend, that such licences cannot be granted, because the instrument in question, inserted in the third patent by Mr. Cooke, is constructed essentially of parts, the exclusive right of using which, in such cases, it has been agreed shall rest with me. And it would be a case of great injustice to allow that, after the specific agreement above mentioned had been made, the subsequent insertion of another form of the in- 391. 392.

strument, founded on the same principles, should virtually destroy the privilege intended to be secured by that agreement.

393. In consequence of Mr. Cooke's insertion of this instrument in the patent, I withdrew several things which I had intended to have included had that not been insisted on, because it was quite unnecessary to claim the same principle twice. Amongst these omissions were the instruments with double magnets, represented in my drawings, and the alarum with the adhesive magnet. These withdrawals, however, cannot affect my rights.

394. My exclusive claim is not to be limited to the particular forms of the instruments represented in sheets I. II. and IV. of the third patent, but extends to all instruments secured by the specification of that patent, and which are founded on my new inventions. Thus the alarum with the new magnet, separate from the telegraph, though not distinctly represented in the drawings, is, since it is secured by the specification, an instrument which is included in my right. I had originally intended that it should be in the drawings, but omitted it on being assured that it was sufficiently secured without.

396. Again, my printing apparatus, though not expressly represented or described in the patent, since it is but an addition to an instrument of my invention which is fully secured, I also claim as belonging to my exclusive privilege.

397—490.

In the Matter of the ARBITRATION be-
tween WILLIAM FOTHERGILL COOKE
and CHARLES WHEATSTONE.

ADDRESS laid before the ARBITRATORS by Mr.
WILSON, at the Meeting held on Saturday the
27th February 1841, as an INTRODUCTION to the
EVIDENCE to be adduced on Mr. COOKE's behalf.

GENTLEMEN,

THREE years ago Mr. Cooke sought and ob- 491.
tained, in a former arbitration, protection against See Cooke's
Professor Wheatstone's encroachments. The pre- Case, 70—72
sent arbitration is a second proceeding of the same and 179—184.
kind, and with the same object. It is in substance
an action in which Mr. Cooke appears before you
as plaintiff, to establish by evidence the justice of
a series of complaints which he has been making,
during the last two or three years, to Professor
Wheatstone himself. Thus the agreement of re- 492.
ference recites, that the arbitration was agreed Page 1.
upon in consequence of Mr. Cooke's having re-
presented to Professor Wheatstone that he had been
subjected to constant annoyance and serious injury
by erroneous notions generally received of his posi-

- tion relatively to Professor Wheatstone, in consequence of the publication of erroneous statements ; and the agreement afterwards proceeds to direct the Arbitrators " to ascertain the relative positions of the parties," by determining " in what shares, and with what priorities and relative degrees of merit, they are co-inventors of the Electric Telegraph ; due regard being paid to the original projection thereof ; to the development of its laws and properties ; to the practical introduction of it into the United Kingdom ; to the improvements made upon it since its introduction there ; and to all other matters which the Arbitrators shall think deserving of their consideration." I am prepared to lay before you the most objectionable of the publications referred to in the agreement of reference, and there can be little doubt that permission might be obtained at your request to inspect the original notes of Professor Wheatstone's evidence before the
493. Cooke's Case, 195—230.
494. Select Committee. But, indeed, if there were ever any doubt how far Professor Wheatstone is responsible for the erroneous statements in question, he has himself removed it ; for in his letter of the 26th October last which immediately led to this arbitration, and in the case since deliberately prepared by himself for the Arbitrators, he has now for the first time affirmed in his own person, and on his own responsibility, all the misrepresentations which during several years Mr. Cooke has been
495. Wheatstone's Case, *passim*.
- calling on him to correct. So that, in short, the question before you comes to this point : Professor

Wheatstone has undoubtedly by some means obtained for himself the entire merit of the invention of the Electric Telegraph, so exclusively as to place Mr. Cooke in a questionable position whenever his name is mentioned in connexion with it elsewhere than among his own immediate friends; Professor Wheatstone now deliberately and solemnly justifies what he has been doing; and the Arbitors have to determine whether they will allow him to keep all that he has taken possession of, or award that some part of the authorship of the invention (whatever that part may be) shall be transferred to Mr. Cooke.

I do not intend to occupy your time by repeating the narrative of facts contained in Mr. Cooke's case; but shall rather endeavour to bring his claim clearly and precisely before you, with an explanation of the grounds upon which it is made, and a concise outline of the evidence which I am about to adduce in support of it, and in refutation of the defence now for the first time set up by Professor Wheatstone. It must have struck you, Gentlemen, that the cases of the two parties evince a very different spirit. Mr. Cooke's case, whether its conclusions be right or wrong, at least states plainly what he means to be understood, and shows an equal readiness to praise what is meritorious, as to blame what appears to be of a contrary character. Professor Wheatstone, on the other hand, has adopted a line of defence, which, if admissible anywhere, ought to be confined to the technical forms

496.

497.

498.

- of a court of law. He has, if I may be allowed the expression, *pleaded the general issue*, claiming every thing for himself and allowing nothing to his partner; in the hope, apparently, of retaining all he can. I ask you, Gentlemen, to regard Professor Wheatstone's case in this point of view, for this reason;—that it will be my unpleasant duty to prove to you that all his material statements are utterly unfounded: it is therefore a satisfaction to view his case rather as a technical pleading, on which perhaps a mistaken judgment might lead him to put the best colour he could; rather than as a statement of facts, in which (had he viewed his case in that light) his feelings as a gentleman would have told him that he was bound to state only such
499. facts as he felt certain had really occurred. I am sorry to say that this is not all. Had Professor Wheatstone merely advanced statements which can be disproved, it might be regretted that he should have spoken positively from memory alone; but when upon statements which are unfounded—which can be proved to demonstration to be unfounded—he has dared to rest insinuations against another man's character; a comparatively venial charge becomes a most seriously important one: and if, when the proofs are brought before him, he does not retract the unfounded charges which he has advanced, I respectfully conceive that the Arbitrators are bound to do away the effect of his insinuations by testifying in their award their unqualified disapprobation of his conduct.

Stated and
answered,
infra.

Gentlemen, it may tend to simplify this inquiry, 500.
if you will first consider in what the merit of the
Electric Telegraph really consists. If the inven-
tion were to be described generally in a few words,
how would you describe it? Might it not be called
an application of a few known principles, by means
of a few simple contrivances, to produce a practical
result, which the experiments of scientific men,
though their attention had been directed to the
subject for a long series of years, had failed to pro-
duce? The merit of the invention must then con-
sist, in a very great degree at least, in the *practical*
realization of that which had been before an idea,
or an experiment. The invention should be viewed,
I submit, in the light of the important practical
result for the first time attained, and not merely or
principally with regard to the exact contrivances
used for attaining it; for if the result attained were
not new and very important, there would be little
or nothing worth contending for in the forms of
the instruments. Suppose that Mr. Cooke had 501.
done nothing more than this; that he had seen a
well-known scientific experiment on Electric Tele-
graphing, and had conceived in a general way a
mode in which it might be turned to practical ac-
count; that he had laid his practical views before
an experimental philosopher, and that the latter
had worked them out;—it would not, I submit, be
just, even in that extreme case, for the scientific
man to suppress his partner's name altogether, and
call himself the inventor of the whole. But the 502.

case supposed does not approach to that which I am prepared to prove before you, beyond dispute, by instruments now extant; by contemporaneous letters bearing postmarks; by letters and papers in Professor Wheatstone's own writing, and other equally conclusive documentary evidence: not less than by the unexceptionable testimony of Mr. Hawes, Mr. Hoppner, Mr. Farey, Mr. Lane, and other witnesses, in addition to the straight-forward and consistent evidence which Mr. Cooke will himself give upon his oath. It will be proved to you that it is strictly true, as stated in Mr. Cooke's case, that Mr. Cooke had projected and in a great measure worked out the entire basis of both the galvanometer and the mechanical modes of applying electricity to telegraphic purposes, before Professor Wheatstone had advanced beyond the theoretical speculations of other philosophers. It will be proved to you that during a year before the spring of 1837, a date at which Professor Wheatstone by his letter of the 26th October last, and also by his case, admits that he himself had no practical invention; Mr. Cooke abandoned every other pursuit for the Electric Telegraph; invented the Galvanometer Telegraph within three weeks after he took up the subject; immediately afterwards conceived the mechanical form, and was clear-sighted enough to see that the latter was the great object to be aimed at; came to London from Germany for the purpose of making the mechanical form; made the first mechanical instrument, comprising the principles of

503.
Cooke's Case,
4.

504.
See extracts,
infra, 522,
523.

Cooke's Case,
12.
Ibid. 18.

Ibid. 27.

Ibid. 30, 31.

Ibid. 33--36.

every thing since done in the mechanical form, except the escapement principle, and even experi- Ibid. 37, 38.
 mented for a long time upon that, so clear and practical and far-sighted were his views; wrote a pamphlet Ibid. 40.
 containing an entire practical system of Electric Telegraphing; exerted himself to introduce the Ibid. 41.
 telegraph on the Liverpool and Manchester Rail- Ibid. 44, 45.
 way, and at the recommendation of the Directors made instruments of the mechanical form, which were afterwards at work for some time on the London and Birmingham Railway, in the summer of 1837, and were exhibited there at work to Mr. Robert Stephenson and the Directors, and shall now be seen by the Arbitrators at work:—and Ibid. 46, 47.
 finally, when on the very eve of applying for his patent, consulted Dr. Faraday and Dr. Roget, and then Professor Wheatstone, upon a scientific difficulty, which he himself had discovered by experiment, and which was new to those three eminent philosophers. I maintain, Gentlemen, that it was then, *and not till then*, that Professor Wheatstone 505.
 became connected with the Practical Electric Tele- Ibid. 48—50.
 graph; and that up to that time he had done nothing in any respect more practical than his telegraph with common electricity and a revolving mirror, or his idea, to which his letter refers, of a telephone between London and Edinburgh.

Let me ask you, Gentlemen, to suppose for a 506.
 moment that the facts which I have briefly sketched have been proved, as they shall be proved, to your satisfaction; would you not in that case think that

even if Mr. Cooke stood below Professor Wheatstone (which you will find to be by no means the case) in the practical improvements made after the parties became connected together, he would still be entitled to a prominent position as original projector of the Practical Electric Telegraph ; or in the words of his

Cooke's Case,
6.

case, as "THE PROJECTOR OF THAT ENTIRE SYSTEM OF PRACTICAL OPERATIONS, WHICH HAS EMBODIED IN THE FORM OF A USEFUL PRACTICAL INVENTION THE IDEA LONG FLOATING IN THE SCIENTIFIC WORLD OF

507.
Wheatstone's
Case, 241—
260.

AN ELECTRIC TELEGRAPH ?" I do not dispute Professor Wheatstone's statements that he had, for about 15 years before Mr. Cooke consulted him, directed his attention occasionally to the transmission of sound, and to scientific researches in electricity ; that he had discovered the exact speed of common electricity, and had proposed various ingenious methods of applying electricity to telegraphic experiments ; but I maintain my sincere belief, founded upon the whole of his dilatory proceedings, that he never before his connexion with Mr. Cooke felt the inspiring hope of rendering his researches available to national or even to practical purposes, and that they would not in his hands, after another 15 years, have terminated in the present invention of the Practical Electric Telegraph. How strikingly opposed to these dilatory proceedings, scattered over a long series of years, was Mr. Cooke's extraordinary and undivided devotion to the Electric Telegraph from the first hour the idea of it entered his mind, continued with unabated zeal down to the present day !

Professor Wheatstone says that Mr. Cooke de- 508.
 rived his principal theoretical knowledge from Mrs. Wheatstone's
 Somerville's work. But if he is the real projector Case, 274.
 of an important national invention, does not his very
 want of theoretical knowledge make his invention
 more striking and more meritorious? If a great
 man strikes out for himself a new path or sees
 further than others, we admire the boldness and
 originality of his conceptions. Suppose an eminent
 man like Professor Wheatstone had taken the part
 which I shall prove to belong to Mr. Cooke, would
 you allow his name to be ever afterwards separated
 from the Electric Telegraph? If you would not, 509.
 there is a more urgent reason for doing justice to a
 private gentleman who does the same thing under
 immeasurably greater disadvantages. Let the
 parties stand upon a fair and equal footing. If
 Professor Wheatstone can prove that his 15 years'
 telephonic and electric researches resulted in the
 Practical Electric Telegraph, let Mr. Wheatstone
 be established as the inventor of it; but if the Prac-
 tical Electric Telegraph originated with, and was
 brought into use by Mr. Cooke, you will not, you
 cannot, deprive him of his invention because he
 arrived at it without passing through a similar
 ordeal; or because he afterwards sought in another
 the aid of those scientific qualifications in which he
 felt himself to be deficient.

Hoping, gentlemen, that you are now satisfied 510.
 that Mr. Cooke's claim to the PROJECTORSHIP—I Outline of

Mr. Cooke's
evidence in
support of his
projectorship.

mean to the realization of the Electric Telegraph as a practical enterprise—if it can be established by proof, is the most important point which can come before you ; the point indeed upon which this whole inquiry turns, for if it be established all minor differences can be easily adjusted ; I proceed in the next place to give an outline of the evidence upon which it rests. The first and principal branch of evidence will relate to what Mr. Cooke did before he consulted Professor Wheatstone. This will be proved beyond dispute by the instruments themselves ; Mr. Cooke's pamphlet ; the correspondence which took place with gentlemen connected with the Liverpool and Manchester Railway ; Mr. Cooke's posted letters to his friends ; Mr. Cooke's own evidence ; and that of Mr. Hoppner, who was present with him at Möncke's experiment and took a deep interest in the invention of the first Galvanometer Telegraph ; Mr. Lane's evidence ; and that of two witnesses from the country.

511.
The direct evi-
dence of what
he had done.

512.
Collateral
proofs.

But though the direct evidence of what Mr. Cooke did may be the most important part of his case, there is other collateral evidence which is very strong also. First, In the *intrinsic probability* of the case. It is evident that Professor Wheatstone had turned his mind to the Telephone and to the Electric Telegraph for 14 or 15 years, without any practical result. This is in fact admitted in his case, but it is still more distinctly stated in his letter of the 26th October last, which contains the following passage :

513.
Sect. 1. In-
trinsic proba-
bility.

See extracts,
infra, 523.

514. “ When you (Mr. Cooke) first proposed a partner-

ship, you know how strongly I opposed it, and on what grounds I did so. I said that I felt myself perfectly confident of being able to carry out my views to the ends I anticipated ; that I fully intended to do so, to publish the results, and then to allow any person to carry them into practical effect:" so that, on his own showing, he not only had not, when Mr. Cooke consulted him, carried his researches into practical effect, but it was not even his intention to do so ; nay more, he was not yet even preparing for his intended publications. Now, within two- 515.
and-a-half months after Mr. Cooke consulted him, a patent was applied for ; and within four months after the sealing of the patent, the Chairman and London Directors of the London and Birmingham Railway Company were decidedly in favour of laying down the Electric Telegraph from London to Birmingham, in consequence of a course of experiments which letters will prove to have been undertaken and satisfactorily concluded within those four months, by Mr. Cooke, upon their line and at their expense.

The statements advanced by Professor Wheatstone in his case to prove, not only that "he had paid great attention to the subject of telegraphic communication by means of electricity" (which as a part of his extensive scientific researches is not disputed), but also "that he had made important practical advances long before he had any acquaintance with or had ever heard of Mr. Cooke," also tend when compared with the real facts to cor-

516.

Sect. 2. Refutation of Professor Wheatstone's alleged practical advances.

roborate Mr. Cooke's claim to the projectorship ; for, as I shall prove to you that his statements on this subject are inconsistent with his other statements, and contrary to the facts, and also that whatever truth there is in them can be traced to trifling circumstances of no practical consequence ; his "important practical advances" must fall to the ground. The points on which he relies are thus stated in his case.

517. "Some time before Mr. Cooke introduced himself to me, I considered my experiments to be sufficiently matured to enable me to undertake some important practical result.

Wheatstone's
Case, 263—
267.

518. "I informed Mr. Fox, an engineer of the London and Birmingham Railway, of my expectations, and told him of my willingness to superintend the establishment of an Electric Telegraph on that railway.

519. "I had also made arrangements for trying an experiment across the Thames, from my lecture-room to the opposite shore. Mr. Enderby kindly undertook to prepare the insulating rope containing the wires, and to obtain permission from Mr. Walker to carry the other termination to his shot-tower. After many experiments had been made with the rope, and the permission granted, I relinquished the experiment, because after my connexion with Mr. Cooke it was necessary to divert the funds I had destined for this purpose to other uses. What I have above stated is sufficient to show that I had paid great attention to the subject of telegraphic communication by means of electricity, and had made important practical advances, long before I had any acquaintance with, or had ever heard of Mr. Cooke. My experiments had also been announced in print in the Magazine of Popular Science for March 1837."

520. The first of Professor Wheatstone's practical advances was, as you will observe, his volunteering

“to superintend the establishment of an Electric Telegraph on the London and Birmingham Railway”—TO SUPERINTEND THE ESTABLISHMENT OF AN ELECTRIC TELEGRAPH ON THE LONDON AND BIRMINGHAM RAILWAY.

Let me first beg of you, Gentlemen, to compare Professor Wheatstone's statement in this respect with the following passage in his letter of October:— 521.

“When you first proposed a partnership, you know how strongly I opposed it, and on what grounds I did so. 522.

“I said that I felt myself perfectly confident of being able to carry out my views to the ends I anticipated; that I fully intended to do so, to publish the results, and then to allow any person to carry them into practical effect.”

“I told you that while I admired the ingenuity of your contrivance, I had no opinion whatever of its applicability to the purpose proposed; and I urged that in the position in which I stood, to associate my name with that of any other person would diminish the credit which I should obtain by publishing separately the results of my own researches.”

Also with the following passages in his case:— 523.

“Mr. Cooke's intention was, as he told me in an early stage of our acquaintance, to take out a patent for his invention; mine was, *when I had finished my experiments, to publish the results, and then allow any person to carry them into practical effect.*” Wheatstone's Case, 280.

“Neither my occupations nor my inclination qualified me for the part Mr. Cooke promised to perform.” Wheatstone's Case, 283.

“At first I strongly objected to this partnership; I urged that by associating myself with another person I should be putting him in a position to claim the merit of what I had done; whereas, standing alone, I could by publishing obtain Ibid. 284.

the credit of my own researches, without other persons having the right to interfere."

524. Mr. Cooke has paid a visit to Mr. Fox* near Birmingham, and has shown him Professor Wheatstone's statement; but Mr. Fox has no recollection upon the subject, nor can he detect among his papers any trace of a proposal to him. If Professor
525. Wheatstone means seriously to contend that his offer to Mr. Fox "to superintend the establishment of an Electric Telegraph on the London and Birmingham Railway," was any thing beyond the expression of a passing idea; or, in short, that it was at all of a more practical character than his "ideas respecting *establishing* a telephonic communication between London and Edinburgh," — it will be at
- Wheatstone's Letter of 26 October 1840. least incumbent on him to call Mr. Fox as a witness, and to endeavour to bring the circumstances to his recollection; and he must also bring before you the system and the instruments which he proposed to adopt.

526. But further, if it is inconsistent with Professor Wheatstone's other statements that he should have volunteered to any one "to superintend the establishment of an Electric Telegraph on the London and Birmingham Railway," it is also unlikely that his proposals for such an important undertaking would have been made to Mr. Fox, who was at the time only a sub-assistant engineer. When Mr.
527. Cooke shortly afterwards proposed to *try experiments* on the same railway, he obtained an intro-

* Now Sir Charles Fox.

duction to the chairman and secretary, the latter of whom introduced him to Mr. Robert Stephenson the engineer; and on the second or third day after his introduction to the chairman, Mr. Cooke was busily at work, under Mr. Stephenson's immediate sanction, in the large carriage room at Euston-square, which had in the mean time been cleared for his use. All this must have taken place very shortly after Mr. Wheatstone's offers to Mr. Fox; and yet as soon as the Directors heard of the Electric Telegraph, they entered upon a trial of it with the utmost expedition and ardour, *not as a continuation of any old proposals, but as an entirely new thing*; and within three months afterwards the London Directors and the Engineer were only deterred by the opposition of the Liverpool Directors from laying down the telegraph to Birmingham. 528.

The truth is,—and it will show on what narrow premises Professor Wheatstone founds his principal claims,—that Mr. Cooke accidentally saw a signal pipe being laid down at the Euston-square station; that on mentioning the circumstance to Professor Wheatstone, the latter intimated his acquaintance with Mr. Fox, and proposed applying to him:—however, Mr. Cooke obtained an introduction to head quarters, as I have already mentioned. 529.

I cannot forbear to conclude my remarks on the first of Mr. Wheatstone's "practical advances," by reading a few passages from a private letter written by Mr. Cooke by post to his family on the 2nd July 1837, which I shall presently lay before you, and 530.

which describes in a graphic and amusing manner the origin of the experiments on the London and Birmingham Railway.

531. "My dearest Mother, 2nd July 1837.
- "Though having good news to impart, I could not find time till now to write you a few lines; every moment being engaged from six in the morning till ten or eleven at night.
532. On Friday, I called on Mr. Joshua Walker, and imparted my plan for the fire telegraph; he spoke handsomely of it, but recommended my proving the practicability of the general principles, before I attempted to introduce a project
533. involving the disturbance of the pavement. I then expressed my wish to try experiments on the railroad. 'There,' he said, 'I can at once assist you;' and within half an hour introduced me to the chairman and secretary of the London and Birmingham Railroad. They both entered warmly into my views and appointed the following day for a further
534. consideration of the subject. To shorten details; by following up every opportunity that offered itself, and urging forward my suit unceasingly, I got through all the forms, had three interviews with Mr. Stephenson the famed engineer, and got an order for 8 cwt. of copper wire by Friday last; obtained leave to occupy a vast building on the railroad, 165 feet by 100 wide, and had as many men and all the materials I could require placed at my disposal. The order was, 'Let Mr. Cooke have everything he may require.' By strenuous exertions I succeeded in collecting the above vast quantity of wire, cleared the huge workshop of men, and lumber, by the constant labour of from 30 to 40 men, and had nearly half a mile of wire arranged by Friday night: proceeding slowly on Saturday morning, having to teach all the men employed, viz. eight carpenters, two wire-workers, and eight boys, their distinct duties, we got forward more rapidly towards evening; and at five o'clock, when the men left off work, I had about four miles of wire well arranged, and hope to get all nearly done by to-morrow

night. You may imagine the task, when I tell you that 2,888 nails have been put up for the suspension of the wires."

The proposed Thames experiment is a matter of less consequence; and if Professor Wheatstone had only stated that he had thought of it before Mr. Cooke consulted him, no objection would have been made to his statement. But when he deliberately alleges that he *had made arrangements* for trying the experiment; that Mr. Enderby undertook to prepare the insulating rope; and that, *after many experiments had been made with the rope*, he relinquished the experiment *because after his connexion with Mr. Cooke it was necessary to divert to other uses the funds he had destined for it*; his statements, whether important or not, cannot be allowed to pass unanswered, for they are absolutely contrary to the facts. The following is an extant letter, written by Mr. Enderby, *not to Professor Wheatstone but to Mr. Cooke, in the course of Mr. Cooke's superintendence of the preparation of the same identical "insulating rope," the only one made, which Professor Wheatstone says he alone had had prepared; and on which he had tried so "many experiments," "long before he had any acquaintance with or had ever heard of Mr. Cooke," as to entitle the rope to a place in the two "important practical advances," recorded in a deliberate written case as the main grounds of his claim to the invention of the Practical Electric Telegraph.* It will be observed that the letter was written nearly four months after

535.

Supra, 519.

536.

the parties became acquainted ; more than one month after they had become partners ; and only two days before the date of the patent.

Greenwich Ropery, 10 June 1837.

537. Sir,

We have proceeded with the operation of covering the copper wire with hemp, but *previous to forming it into the rope* we should be glad to submit it to your inspection and approval ; and if you can make it convenient to come down here, we should feel obliged by your suggesting such alterations as may appear to you advisable.

We are, &c.

— Cooke, Esq. (signed) Enderby, Brothers.

538. The fact is, that the necessary measurements across the Thames at Waterloo Bridge having been effected by Mr. Cooke and Mr. Lane, a rope of the required length was made by Messrs. Enderby, as the above letter shows, and as other documentary evidence will confirm, under Mr. Cooke's directions. This rope was first tried on the London and Birmingham Railway ; while it remained there, *an accidental shower of rain wetted it through, and destroyed the insulation of the wires, and thus made it evident that the insulation would not continue under water ;* and it was this fortunate accident that saved the parties the ridicule and discredit of a total and very absurd failure in the much talked
539. of cross-Thames experiment. Observe also, that Professor Wheatstone has attributed the abandonment of the experiment to his finding it necessary to divert to other uses the funds destined by him

for this purpose ; yet, in point of fact, *he was never required to destine, and never did destine, any funds for the purpose ; but Mr. Cooke advanced the funds, and inserted his payments as items in his general accounts.* In December 1837, Messrs. Glascott and Co., the tradesmen who supplied the wire for the rope, wrote to Professor Wheatstone a letter, stating that Messrs. Enderby and Co. had referred them to him for payment. Professor Wheatstone immediately forwarded to Mr. Cooke their letter, accompanied by a letter from himself, requesting Mr. Cooke “to have the kindness to see to it,” and observing that “it related to a transaction of which he himself knew nothing.” About March 1838 he wrote to Mr. Cooke another letter containing the following passage : “ I have not a length of wire at the College for any experimental purpose. You will oblige me by returning there to-morrow morning the remainder of the wire enclosed in the rope, which was sent from thence to the station at the commencement of our experiments. It is still at Euston-square, and does not form any part of the Company’s property.” The rope was accordingly sent to him, and has remained in his possession ever since, but was never applied to its destined purpose. He afterwards proposed another Thames experiment, in which he intended to use some earthenware tubes, which he had had made for the purpose ; but Mr. Cooke dissuaded him from attempting it, representing to him that even if the porous character of

540.

541.

542.

the tubes were obviated, their extreme fragility would cause the experiment to fail.

513 I may now appeal to you, Gentlemen, whether I exceeded the truth in telling you that Professor Wheatstone's statements in support of his alleged "practical advances" are *inconsistent with his other statements, and contrary to the facts, and also that whatever truth there is in them can be traced to trifling circumstances of no practical consequence.*

544. And here I leave this subject, with a further observation;—that this is only one out of a number of instances in which you will find the most extensive claims, and even the most serious charges, built upon the narrowest basis of truth: a circumstance which might be accounted for by supposing that Professor Wheatstone has allowed the misrepresentations of others to be repeated again and again in his presence uncontradicted, until he has at length

545. brought himself to believe them. I am sorry to add that the Thames experiment, especially, presents a striking instance of another too numerous class of statements, in which Professor Wheatstone has boldly and positively, and sometimes most circumstantially, advanced upon memory assertions of which he could not possibly feel certain, and *which the weight of his name might have induced the Arbitrators to receive, contrary to the truth, if Mr. Cooke were not happily able to disprove them by conclusive documentary evidence, of the existence of which Professor Wheatstone had not the remotest idea.*

Mr. Cooke's claim to the projectorship is further 546.
 corroborated by the conduct of the parties in 1837 Sect. 3. The
 and 1838. Professor Wheatstone represents in his projectorship
 case, that Mr. Cooke finding that his own instru- further colla-
 ment was inapplicable to the purpose proposed and terally proved
 that Professor Wheatstone's researches were more by the conduct
 likely to be practically useful, proposed a partner- of the parties.
 ship and a joint patent; that Mr. Wheatstone him- Wheatstone's
 self strongly objected to this partnership, and urged Case, 281—
 that by associating himself with another person he 285.
 should be putting him into a position to claim the
 merit of what he (Mr. Wheatstone) had done; that 547.
 Mr. Cooke succeeded in removing his objection by
 a strong assurance, of which the exact words are
 given in the case, that his sole object was to make
 money by the patent; and that eventually, Professor 548.
 Wheatstone (his fears having been thus removed)
 "acquiesced in the arrangement for the sole reason
 that Mr. Cooke appeared to him to possess the zeal,
 ability and perseverance, necessary to make the
 thing succeed as a commercial enterprise." This is 549.
 what Professor Wheatstone *states now*, but how did
 the parties *act at the time*? MR. COOKE'S NAME
 STANDS FIRST IN THE PATENT. Mr. Wheatstone's
 case is silent upon this subject, but his letter of the
 26th October last admits, and Mr. Lane will prove, 550.
 that the priority was yielded to Mr. Cooke after full
 discussion. Professor Wheatstone suggests in his 551.
 letter various reasons for the priority having been
 thus yielded, which reasons are shown in Mr. Cooke's
 case to be unfounded and self-contradictory, with 552.
 See Extract,
 Cooke's Case,
 131.

Ibid. 131.
552.

the exception of one, which is true, but quite inconsistent with Professor Wheatstone's statement in his case that Mr. Cooke's invention had proved to be a failure, viz., that "*Mr. Cooke urged that his invention was more valuable than Professor Wheatstone's.*" Gentlemen, if you believe Professor Wheatstone in this, and then suppose that Mr. Cooke's name did take the lead because his invention actually was what he maintained it to be, viz., more valuable than anything Professor Wheatstone had invented, all is clear and consistent; but it is self-evident, that "*Mr. Cooke's priority, admitted by Professor Wheatstone's own letter to have been claimed on the footing of superiority, and to have been yielded after discussion, cannot by any ingenuity be reconciled with the after-account given of the matter in Professor*

553. Wheatstone's case. It appears to me also to be surprising, that while giving from memory the exact words used in conversation three or four years ago, Professor Wheatstone should not have alluded to a circumstance so strikingly important as the priority of names in the patent; a circumstance too, which he himself thought deserving of three closely-written pages in a private letter of the 26th October. You may remember that Mr. Cooke's case proves what is advanced in that letter to be strangely inconsistent, and wholly unfounded.

Cooke's Case,
129—194.

554.
See extract,
Cooke's Case,
131.

Professor Wheatstone mentions in his letter that one argument used by Mr. Cooke was that "*his pecuniary obligations were greater than Professor Wheatstone's.*" This argument might have been a

strong one if true, but the fact was directly the reverse. *Professor Wheatstone yielded to Mr. Cooke striking pecuniary advantages, in addition to the honorary pre-eminence which he had insisted on and maintained. Professor Wheatstone paid about 555. three-fifths of the expense of the patent, and allowed Mr. Cooke besides, out of the joint proceeds, 130l., being the whole estimated expense of his experiments, though receiving nothing for his own experiments; and it is to be observed that the slender financial means of both parties made these sums so important a consideration at the time, that the leading feature of the arrangement was, as appears by an extant document, that a share of the patent should be sold to meet them. How can Professor Wheatstone reconcile these facts with the position which he now claims? Or with his express statements, that his own experiments on the Electric Telegraph previous to his acquaintance with Mr Cooke had occupied his almost exclusive attention during several years; had been "carried into effect by him at a very considerable expense compared with his then limited means;" and had "prepared the way for the practical realization of an Electric Telegraph more than any experiments that had hitherto been made?" Or with his statements, "that Mr. Cooke's efforts before he became acquainted with Professor Wheatstone were limited to constructing a machine much less capable of being applied to the purpose intended than other inventions previously made; and which machine was never prac-*

Cooke's Case,
67. 556.

Wheatstone's
letter of 26
October 1840.

Wheatstone's
Case, 378.

Ibid. 379.

557. tically employed ; and which was after his association with Professor Wheatstone abandoned as hopeless, and omitted from the patent?" Professor Wheatstone is a man accustomed to the details of business ; he had taken out patents before, and certainly understood such matters at least as well as Mr. Cooke, who had been a soldier in India till his health compelled him to come home a few years before ; nor do I find that in after-times Professor Wheatstone showed any disposition to claim less than what he was entitled to. *Yet you are expected to suppose, that while he started back at the very idea of Mr. Cooke's being enabled to claim a share in the merit of his researches, he allowed him to claim on the ground of superiority in the invention, and to obtain, the priority in a patent from which his invention was omitted as hopeless : that for a joint patent, for Professor Wheatstone's invention, but in which Mr. Cooke was to have a half share, Professor Wheatstone subscribed 80l., and Mr. Cooke only 50l., towards expenses ; and finally, that while Professor Wheatstone neither obtained, nor even asked, anything for experiments, which his letter tells you had occupied his almost exclusive attention for several years, and had been "carried into effect by him at a very considerable expense compared with his then limited means ;" which had "prepared the way for the practical realization of an Electric Telegraph ;"—for these*
558. *persevering, expensive, successful, and practically valuable experiments, on which every thing depended,*
- 559.

Supra, 547.
Wheatstone's
Case, 281—
285.

Professor Wheatstone obtained no allowance—asked no allowance—at the time when he was agreeing that a share in the patent should be sold to repay Mr. Cooke the 130l. which it had cost him to construct his hopeless and abandoned machines!

Gentlemen, all this proves that Mr. Wheatstone really must have looked upon his case only as a technical pleading, and that in his evidence he will find himself bound, as a man of sense and honour, to admit that it is incorrect; for to maintain it would do as little credit to his head as to his heart.

Again, the first arbitration affords another instance in which the conduct of the parties confirms Mr. Cooke's claim to the projectorship, and cannot be reconciled with Professor Wheatstone's case. Though one reason given by Mr. Wheatstone in his letter for Mr. Cooke's priority, was that he "intended to leave to him all negotiations," yet within four months after the date of the patent, his interference in Mr. Cooke's negotiations had become so intolerably perplexing that an arbitration was inevitable. The first arbitration in consequence took place in October and November 1837, before Mr. Benjamin Hawes, the Member for Lambeth. Mr. Cooke then claimed and obtained, as projector of the practical invention, an absolute legal protection (which stands at this day secured to him by a partnership deed, in which his name took the lead as a matter of course) against further interference; Professor Wheatstone retaining only a

560.
Cooke's Case,
70—72, 179—
184.

561.

voice in money matters, as joint patentee; and, in cases not provided for by the specifications, a voice in the construction and application of the patent instruments, as scientific partner. I shall presently lay before you the papers connected with this arbitration, and the partnership deed which resulted from it. Mr. Hawes himself will prove what passed before him. You will hear from him that Mr. Cooke's claim to the projectorship was openly advanced throughout the arbitration, and not attempted to be denied; he will tell you that the almost unlimited powers ceded to Mr. Cooke were fully discussed between the parties, and ceded by Mr. Wheatstone himself; the Arbitrator acting rather as a recorder than a judge. He will also inform you that so far from deeming the powers yielded to Mr. Cooke too extensive, he would have felt himself bound to give him far more extensive advantages, if he had been called upon to proceed to an award.

564. Once more; the conduct of the parties in August
 Cooke's Case, 1838, when Mr. Cooke wrote to Professor Wheatstone the letter set out at the commencement of the former's case, further corroborates his claim to the projectorship, and tends to disprove Professor Wheatstone's case; for, after strongly urging him to mention the facts in their true light at an approaching scientific meeting, and to settle the question in the manner which his own feelings as a gentleman and man of science would dictate, that it might rest thenceforth and for ever; Mr. Cooke

concluded by distinctly basing his appeal upon the fact for which I am now contending, viz., his projectorship of the Practical Electric Telegraph; and his appeal, though fruitless, was allowed to pass unquestioned.

Another branch of collateral evidence will be found in the account given by Professor Wheatstone's case of the earlier interviews which took place between the parties, on their becoming acquainted with each other in the spring of 1837. Observe, Gentlemen, that Professor Wheatstone has laid before you, on this subject, a lengthened and very circumstantial statement, positively advanced respecting private scientific interviews, with a gentleman known to have been without scientific friends. In all reasonable probability, therefore, Professor Wheatstone's statements could have been answered only by counterstatements, and might therefore be expected to pass current upon the authority of his established reputation. Gentlemen, I shall answer them by POSTED LETTERS written by Mr. Cooke to his family at the time, and bearing such evident marks of truth that you will not hesitate to give absolute credence to all they contain. But observe, I am only under the necessity of asking you to trust them for some minute circumstances, *which could not at the time be supposed to be of the least consequence*. They will prove that Professor Wheatstone's statements and his insinuations are at an equal distance from the truth; and his inconsistencies will therefore, when exposed to view, tend

Cooke's Case,
9.

565.

Sect. 4. The projectorship further collaterally proved by disproving Professor Wheatstone's statements as to the earlier interviews, &c. See extracts, infra, 568—574. Wheatstone's Case, 266—273. Cooke's Case, 46—53.

566.

567.

strongly, by way of contrast, to bring out and corroborate Mr. Cooke's consistent claim to the projectorship.

568. Mr. Wheatstone's account of the matter is as follows :—
 Wheatstone's Case, 266—
 273.
 Cooke's Case, 46—53.

“What I have above stated is sufficient to show that I had paid great attention to the subject of telegraphic communication by means of electricity, and had made important practical advances, long before I had any acquaintance with or had ever heard of Mr. Cooke. My experiments had also been announced in print, in the Magazine of Popular Science for March 1837.

569. “I believe, but am not quite sure, that it was on the 1st of March 1837 that Mr. Cooke introduced himself to me. He told me that he had applied to Dr. Faraday and Dr. Roget for some information relative to a subject on which he was engaged, and that they had referred him to me as having the means of answering his inquiries. He gave me no clue as to the purpose he had in hand. I replied, that he was welcome to any information I could give him; and that the experiments I had been making for some time relative to employing electric currents for the purpose of telegraphic communication would enable me to give him much of the information he required.

570. “At our next interview, which was very shortly after, he told me that he also was working at an electrical telegraph, and that the questions he had previously put to me related to this subject; but he said nothing respecting the nature

571. of his experiments. It was on this occasion, I believe, that I showed him my permutating key-board, and mentioned to him my proposal for ringing an alarm by means of an electro-magnet, with various other things; and invited him to the College to see my experiments in action; all this occurred before Mr. Cooke communicated to me any thing he had done.

“ At length Mr. Cooke showed me some of his drawings and models, and though I could not fully comprehend the full scope of them at the time, I saw and understood enough to assure me that his instrument was a massive complicated piece of machinery, intended to be set in action by the attractive power of an electro-magnet. On seeing this, and relying on my former experience, I at once told Mr. Cooke that it would not and could not act as a telegraph, because sufficient attractive power could not be imparted to an electro-magnet interposed in a long circuit; and to convince him of the truth of this assertion, I invited him to King’s College to see the repetition of the experiments on which my conclusion was founded. He came, and after seeing a variety of voltaic magnets, which even with powerful batteries exhibited only slight adhesive attraction, he expressed his disappointment in these words which I well remember— ‘ Here is two years’ labour wasted.’ ”

The material points in the statements which I have just read appear to be these:—

1. The inference apparently intended to be conveyed, that Mr. Cooke came to Professor Wheatstone after and in consequence of the announcement of his experiments in the Magazine of Popular Science for March 1837. To this I answer, that I will produce a letter, bearing a post mark, and proving that Mr. Cooke consulted Professor Wheatstone on the 27th February. And here I beg to observe, once for all, that I have not seen any of Professor Wheatstone’s various papers and publications on the Telephone and the Electric Telegraph. He has referred in his case to several of them, but so fully am I convinced that they are all equally unconnected with the Practical Electric Telegraph,

that I have not thought it necessary to look into them.

577.
Supra, 572.
Wheatstone's
Case, 303.

- II. There is an intimation which is confirmed by a positive statement in another part of the case, not only that Mr. Cooke did not in the first instance inform Professor Wheatstone that he was engaged on an Electric Telegraph, but also that it was not till after several interviews and consultations that he at length mentioned his intention to employ an electro-magnet. To this I answer, that it is out of all probability that Mr. Cooke should have consulted Dr. Faraday and Dr. Roget upon a plain definite scientific difficulty not necessarily involving a disclosure of his invention; and that on going from them, on the same day, to Professor Wheatstone, for further advice upon the same subject, and also at repeated subsequent consultations, he should have been entirely silent upon the subject about which he came; like the Persian who required an artist to paint his wife's portrait without letting him see her face. Professor Wheatstone's statement is not only improbable, but (I do not use the terms offensively) it is absolutely impossible and absurd; for if Mr. Cooke did not consult him on the electro-magnet, what did he consult him upon? I must leave it to himself to explain this. *I shall also prove the real facts by a letter from Mr. Cooke to his family, written on the very day, and bearing a post mark.* If further proof of the nature of Mr. Cooke's inquiries be wanting, let Dr. Faraday and Dr. Roget be requested to give evidence.

III. A third statement, full of meaning, is that 581.
 Mr. Cooke did not disclose his instrument until ^{Supra 571,}
 572.
 after he had seen Professor Wheatstone's. In answer
 to this, I shall produce a letter, written by Mr.
 Cooke to his family on the 14th March, 1837, bear-
 ing a post mark; and *proving, that on the failure*
of experiments by which the parties had been jointly
endeavouring to excite magnetism at long distances,
"Mr. Cooke explained the nature of his discomfited
instrument to Professor Wheatstone, and that Mr.
Wheatstone, in return, imparted his to Mr. Cooke."

IV. The same letter will also refute a fourth 582.
 point, viz., that relying on his former experience, ^{Supra 573.}
 Professor Wheatstone at once told Mr. Cooke that
 attractive power could not be imparted to an electro-
 magnet, interposed in a long circuit. The fact is,
 that the point was as new to Professor Wheatstone
 as it was to Dr. Faraday and Dr. Roget; and that
 it was determined, *not by his previous experience,* ^{Cooke's Case,}
but by joint experiments ^{51, 52.} tried on several occasions
 on his four miles of wire.

V. The letter of the 14th March will also dispose 583.
 of a fifth point, which is the last I shall mention,
 viz., that after seeing Professor Wheatstone's expe-
 riments, Mr. Cooke expressed his disappointment ^{Supra 574.}
 (that is, as the context shows, his final disappoint-
 ment—his abandonment of his former hopes), in
 these words, which Professor Wheatstone well re-
 members; "Here is two years' labour wasted"—
 (words which, by the way, could not possibly have
 been used, for Mr. Cooke had been at work exactly

584. one year, and not two):—the letter of the 14th March will prove the unfavourable conclusion of the joint experiments, and also a further fact, viz. : that so far from abandoning his plans, the temporary disappointment only caused Mr. Cooke to enter into the subject more deeply and indefatigably than before ; and that he immediately conceived in their general bearings, and even described and sketched with some minuteness, those very changes in the proportions of the magnet and its coils, which Professor Wheatstone afterwards, in 1839, worked out philosophically (not only on the general principle, but in the very mode, sketched in Mr. Cooke's letter of the 14th March 1837) into his recent discovery of the laws of the electro-magnet ; a discovery which he has attributed, both by his letter of the 26th October and by his case, to original researches of his own, commenced at a much later date. This branch of the case presents a striking instance of the insinuations of which I have already complained: *had Mr. Cooke not been able to adduce clear evidence, the existence of which was little contemplated by Professor Wheatstone, in refutation of the latter's statements, it would have gone forth to the world, on the authority of his established reputation, that Mr. Cooke heard of his experiments, introduced himself, and contrived to obtain a sight of them, whilst he concealed his object ; and thus, under false pretences, and with insidious views, obtained a position which enabled him to claim a leading share in the credit due to Professor Wheatstone's invention.*

Wheatstone's
Case, 332—
334.

Cooke's Case,
96, 97.

585.

I shall mention one more branch of collateral evidence in support of Mr. Cooke's projectorship. Professor Wheatstone states in his case that the Magnetic Needle Telegraph, or, as Mr. Cooke designates it, the Galvanometer Telegraph, is entirely and exclusively Professor Wheatstone's own invention. Now, it being an evident fact, that *something* which appeared simultaneously with Mr. Cooke's application to him, brought the Electric Telegraph forward in a new character—in a condition essentially differing from its condition during Professor Wheatstone's previous long course of researches and experiments—in short, in the new form of a practical and patentable invention;—allow me, Gentlemen, to direct your especial attention to the grounds on which Professor Wheatstone rests his claim to the entire and exclusive authorship of the patented invention; for, if in a statement so deliberately and carefully prepared as his case, *he has overlooked some of the most essential points to which the Electric Telegraph owes its practical existence*, his case will confirm, instead of weakening, Mr. Cooke's claim to the projectorship. He brings forward three points (besides the alarum which he treats separately in another part of his case) as constituting the essential merit of the Galvanometer Telegraph, viz.:—

586.
Sect. 5. Further collateral evidence from Professor Wheatstone's claims to the Galvanometer Telegraph. Wheatstone's Case, 288—290.

587.

588.

589.

1. The various parts of the Vertical Diagram.
2. The permutating principle of the Key Boards; and
3. The application of the theory of Ohm to Telegraphic Circuits.

590. The vertical diagram is out of the question ; for, though a most valuable improvement, it was invented after the formation of the partnership, and therefore could have no place in the projectorship of the practical invention for which it had been previously determined to take out a patent ; and it would have been more candid in Professor Wheatstone to state this important date plainly and openly, instead of concealing it.

591. Nor was the permutating principle of the keys identical with the projectorship ; for the only effect of that principle was to do by four wires, less perfectly, the work which could be done better, though more expensively, by six. If then, a Practical Electric Telegraph with six wires had been a thing already made and known, the permutation of the keys would have been an important improvement upon it ; but if no means had been yet devised, by which even six wires could be practically applied to telegraphic purposes, the substitution of four for six might be a meritorious scientific experiment, and prospectively valuable, but it could no more solve the main problem than an improvement on any other of the elements afterwards used.

592. Again, the theory of Ohm is equally foreign to the projectorship. For, in the first place, what Professor Wheatstone has done towards working out philosophically the laws of the Electric Telegraph has been done since the formation of the partnership, and since the application for the first patent ; and I can show that Mr. Cooke has done

at least as much as Professor Wheatstone in the way of practically obviating even scientific difficulties.

But even supposing, for the sake of argument, 593.
that Professor Wheatstone *had* applied the theory of Ohm to telegraphic circuits, would he be justified in calling this the most important point of all? Certainly not, upon his own showing; for he only says, that it "enabled him to ascertain the best proportions between the length, thickness, &c., of the multiplying coils, and the other resistances in the circuit, and to determine the number and size of the elements of the battery, to produce the maximum effect." But if no existing invention enabled him 594.
to produce *any practically useful effect at all*, the application of the theory of Ohm could be only a scientific experiment, or at best a prospective improvement on an invention which had not at the time any existence. For it is self-evident, that a person who, without being acquainted with the theory of Ohm, should alone have discovered the practical mode of communicating intelligence by electricity, would have been the real inventor or projector of the Electric Telegraph; although his ignorance of the theory of Ohm might make more powerful batteries, or thicker conducting wire, or better insulation necessary, or might confine his telegraph for a time within narrower limits. For 595.
observe, Gentlemen, that the problem to be solved was not to convey signals to a very great distance all at once, but to communicate intelligence by

Wheatstone's
Case, 290.

galvanism ;—not, in the first instance, to dispense with intermediate stations between London and Liverpool, but to make an Electric Telegraph which would work practically and usefully between London and Liverpool, though perhaps at first with a great number of intermediate stations ; and to reduce the number of those stations by degrees, with the hope, possibly, of eventually dispensing with them all. In short, the projectorship cannot be found in any, or all, of the three points which Professor Wheatstone has deliberately brought forward as the essence of the Galvanometer Telegraph. They seem rather to be analagous to the improvements which have been made from time to time in the furnaces and boilers of locomotive engines ; improvements very important in themselves, as improved applications of a known power, but surely quite distinct from the original invention and introduction of the locomotive engine as a practical machine.

597. In what then is it that the projectorship of the Electric Telegraph really consists ? Let me ask you, Gentlemen, what would be the projectorship of a practical electro-magnetic-machine, or of a machine practically superseding steam by air or gas ? Would it be any improved proportion in the parts of the magnet, increasing its power ? Or the most perfect philosophical development of the properties and powers of air or gas ? Obviously none of these ; for such improvements and theories would leave the powers of the electro-magnet, and those of air

and gas, better known indeed, but still as unapplied, as unrealized, as practically useless, as they were before. The real projectorship of the Electric Telegraph is clearly pointed out by a letter from Dr. Reynolds of Liverpool, dated the 26th January 1837, which will come before you in the course of the arbitration ; and in which you will observe that the Doctor, though acquainted with electric theories and experiments, felt something else of a different kind to be implied in the idea of a Practical Electric Telegraph. After expressly alluding to Professor Wheatstone's discovery of the speed of electricity, Dr. Reynolds proceeds thus with reference to Mr. Cooke's Pamphlet :—" Supposing, therefore, an isolated wire were extended from Liverpool to London, we might transmit electricity from one place to the other with the greatest rapidity and regularity ; *but how this power or agency can be applied to communicate signals to the extent required, I cannot conceive.*" What Dr. 598.

Reynolds could not conceive the attainment of, was actually attained by Mr. Cooke's DETECTOR, to maintain the effectiveness of his metallic circuit by tracing every defect occasioned by water, fracture or contact ; his RECIPROCAL COMMUNICATOR, to convey signals, practically and conveniently, backwards and forwards, exhibiting them simultaneously at both termini ; and his ALARUM, to attract attention, practically and conveniently, to an intended communication ;—these essential parts being applied to a complete alphabet of signals ; and being used in 599.

Cooke's Case
18—26.

connexion with practical modes of defending and insulating the wires; and having been projected from the first (as will be clearly proved) with a direct practical view to railways, commerce and
 600. Government. These things, Gentlemen, will be proved to you by extant instruments, by written evidence, and by the unexceptionable testimony of Mr. Hoppner, to have been invented by Mr. Cooke within three weeks after he took up the subject; with little or no aid from theory, and in ignorance of the unavailing experiments of the scientific world during half a century.

601.
 Cooke's Case,
 58—67.

Supra, 550—
 559.

On this practical system the partnership was founded in May 1837. Professor Wheatstone was forcibly struck with the universal applicability of that system to every form of the galvanometer and mechanical apparatus: and though it was with the utmost reluctance that he yielded to Mr. Cooke a position in the partnership, which he acknowledged must place himself second in the invention; yet he *did* yield it to Mr. Cooke's undisputed claims to the invention of the Reciprocal System, the Detector, the Alarum, and the general practical plan.

602.
 Observations
 on the ex-
 pected defence.

Wheatstone's
 Case, 276.

Gentlemen,—I find sufficient intimations in Professor Wheatstone's case of the kind of objection which is about to be made to Mr. Cooke's projectorship. One passage, for example, is as follows:—"I understand from Professor Jacobi, that Baron Schelling of St. Petersburg, exhibited at the

meeting of German Naturalists held at Bonn in 1835, his Magnetic Needle Telegraph; one of the most perfect arrangements made before my experiments, and which appears from Professor Jacobi's description to be almost identical with an apparatus made by Mr. Cooke," &c. In the first place I must 603.
beg to doubt the fact here stated, so far as it may apply to the Detector, the Reciprocal Communicator, and the Alarum, unless Professor Jacobi's attention was particularly called to these three points. I hope, therefore, that if the statement is to have any weight whatever, you will require it to be properly verified. But I would principally call 604.
your attention to the extreme illiberality of the sentiments expressed by it. Professor Wheatstone brings forward a loose account, just received by him from a brother philosopher, of an unapplied and unpublished experiment of a deceased Russian professor. If the meaning intended to be conveyed is that Mr. Cooke knew of the experiment at Bonn, and then brought forward as his own a similar apparatus, I repel the insinuation, and shall disprove it by the clearest evidence: but if Professor Schelling's unapplied and unpublished experiment is brought forward rather to detract from the merit of Mr. Cooke's subsequent practical invention, can such a defence as this be admitted? If it were admissible, what safety could an unscientific inventor ever feel in connecting himself with a scientific partner; especially with a gentleman like Professor Wheatstone, whose opportunities of obtaining know- 605.

606. ledge of what is going on are universal and unbounded? I confidently appeal to you, Gentlemen, whether it can be endured for a moment, that a scientific man should become confidentially acquainted with the invention of a gentleman who asks his scientific aid; be admitted by the inventor as his scientific partner, on acknowledging the inventor's priority, and yielding to him pecuniary advantages; then claim the invention as his own, and covertly avail himself of his whole influence in the scientific world to establish his unjust claim; then, on an arbitration being required, insist upon scientific Arbitrators; and finally, endeavour to maintain his ground by impeaching the invention which he before consented to share with the inventor whom he has injured—and impeaching it in what manner? by coming forward, in London, with his own hearsay statement of some undefined, unapplied, and unpublished experiment, supposed to have been exhibited, by a deceased Russian professor, at a place in Germany, six years before.

607. Gentlemen, the proceedings which take place before you may be talked of throughout the country; and if Professor Wheatstone succeeds in defeating Mr. Cooke's just claims, by raking up every unapplied and unpublished experiment which his scientific connexions may now be able to furnish him with, he will confirm to all the world the common saying, a true saying, I fear, sometimes, though, I hope, not often;—*that an inventor acts more wisely in taking out a defective patent for an*

imperfect invention than in consulting a scientific man.

But, Gentlemen, the case may, I conceive, be put upon broader grounds. Whatever Professor Schelling may have done in Germany or Russia, in 1834 or 1835, Professor Wheatstone did not know of his experiments in May 1837. Mr. Cooke's projectorship having been then distinctly and conclusively recognized, in the striking honorary and pecuniary advantages yielded to him by Professor Wheatstone on the formation of the partnership, and before the Professor had invented the vertical diagram; and having been solemnly reconsidered, and again solemnly and also judicially recognized, with other important advantages, in November 1837, after the invention of the vertical diagram; and not disputed during the three following years; Mr. Cooke must be conclusively recognized as the projector now. You will not allow that when it now appears that Professor Wheatstone has been spending those three years in ungenerously and covertly establishing himself in a position to which he has no title; his unjustly acquired position shall be considered as now sanctioned by prescription, and be confirmed to him, contrary to conclusive inferences arising from his own conduct, contrary to his own written admissions, and a mass of other evidence, by your award;—because, forsooth, he has just now heard from Professor Jacobi, that some undefined scientific experiment was exhibited in Germany in 1835. On the contrary, I am sure

608.

Supra, 550—
559.Supra, 560—
563.

609.

that Professor Wheatstone will find that *the scientific Arbitrators, to whose judgment alone he would submit, will be the first to vindicate an unscientific inventor against scientific tyranny.*

610. I have one more remark to make on this subject. Professor Wheatstone, in his letter of the 26th of October, stated plainly and positively, that in the development of the Galvanometer Telegraph; "he was indebted to no person whatever; that it is, in all its parts, entirely and exclusively his own." He deliberately repeated this assertion in his case; stating there, that the Galvanometer Telegraph "is, to all intents and purposes, entirely and exclusively his own invention, and that the original suggestion of Ampère was all that he borrowed in it;" and "that it was rendered by him complete in all its details." Now the reciprocal communicator and the alarum could not have escaped his attention, for they were engrafted, at various intervals after the parties became connected, upon his permutating key-boards; and they were embodied, together with the detector, in the specification. The question of fact, therefore, if not with regard to the detector, at least with regard to the reciprocal communicator and the alarum, (whatever weight you may think due to those parts) has been reduced by Professor Wheatstone himself to this one single issue: *which of the two parties now before you invented the parts in question, not whether those parts are old or new.*
- Wheatstone's Case, 288.
- Ibid. 322.
- 611.
- 612.
613. For Professor Wheatstone having solemnly asserted that he borrowed nothing but Ampère's original

suggestion ; if it be proved that he also knowingly borrowed from Mr. Cooke the really essential parts of his whole apparatus, he cannot, when the fact is brought home to him, defend himself by a hearsay supposition that Mr. Cooke was not the first inventor of the parts borrowed. It is a trite maxim 614. of courts of law, that a man cannot discredit his own witness ; in other words, that the party who brings forward a witness, in the expectation of his evidence being favourable to himself, cannot, on its turning out to be unfavourable, prove that his own witness is unworthy of belief. Nor could Professor Wheatstone be allowed (were it possible) to prove that to be old, which he himself has claimed, repeatedly, and in the most solemn manner, as new.

I have endeavoured, Gentlemen, to present to 615. you an outline of the grounds and proofs of Mr. ^{As to the} Cooke's claim to the projectorship, as it applies ^{Alarum.} generally to the invention of the Practical Electric ^{Wheatstone's} Telegraph, as a whole. But there is one separate ^{Case, 297—} part of the invention to which Professor Wheat- ^{315.} stone has devoted some pages of his case, and on which I must also trouble you with some separate observations—I mean the alarum: and I must say, 616. that in the whole of Professor Wheatstone's case, unfounded and unjustifiable as I believe it to be throughout, there is only one other part, which I shall presently come to, which appears to me to be equally unfounded and unjustifiable with this ; for,

Alarum

if ever there was an attempt on the part of an eminent and influential man to appropriate to himself, by his superior influence, a thing to which he has no just claim—not the shadow of a pretence to a just claim—it may be seen in Professor Wheatstone's account of “his investigations and their results with regard to the Alarum.” I repeat, Gentlemen, that what Professor Wheatstone states with regard to the alarum is absolutely unfounded from beginning to end; and I feel confident of proving, to your perfect satisfaction, that it is so.

617. Let me ask you to observe what his claim really is. Mr. Cooke's alarum, the earliest specimen of which shall be laid before you, which can be proved to have been made many months before he consulted Professor Wheatstone, stands recorded in all the specifications of the patents, and is at work wherever the Electric Telegraph is in use; *and not only is there no extant description of Mr. Wheatstone's supposed adhesive alarum, in the specifications or elsewhere, but it cannot be pretended by himself that it was ever at work any where, or ever tried any where, or ever made at all.* As to his

618.
Wheatstone's
Case, 305.

statement that Mr. Cooke's first alarum was struck by a pin in the barrel of his mechanical instrument, it is inconsistent with fact; for the first alarum was, as you will see, struck by a hammer, and not by a pin; and even if it had been struck by a pin, it is so evident that the alarum acts on the same principle throughout (being to this day struck

mechanically, on the removal of a detent by the electro-magnet), that whether the mechanical agent were called a hammer or a pin, could make not the slightest difference.

I will now examine the grounds on which Professor Wheatstone has claimed the alarum. He tells you,—

619.
Wheatstone's
Case, 297—
303.

1st. That when he endeavoured to ascertain how a bell might be rung, the attractive power of an electro-magnet first occurred to him. That his experiments at King's College led him to conclude that attraction could not be made available in long circuits, and therefore he had no hopes of being able to discharge an alarum by this means. That he therefore proposed an adhesive alarum, which he mentioned to Mr. Cooke, before he had any knowledge that Mr. Cooke proposed to employ an electro-magnet.

620.

Now, I have already shown that even if the real circumstances of the first interview could not be affirmatively and most satisfactorily proved by a letter written on the very day, it would involve a positive absurdity to suppose that, immediately after consulting Dr. Faraday and Dr. Roget, on one definite scientific defect in the electro-magnet, which had baffled his own experiments at Mr. Lane's, Mr. Cooke should have gone, on the same day, to another scientific man for further advice, and should have consulted the latter, at some length and on several occasions, without giving him any clue to the only possible subject of the consulta-

621.
Supra, 578—
580.

tions ; viz. the electro-magnet : and I again call on Professor Wheatstone to state what Mr. Cooke did consult him upon, if not upon the electro-magnet.

622. But further, Professor Wheatstone has mentioned
Wheatstone's Case, 300, 301. that it was in consequence of results attained by experiment, proving that the attractive power would not answer, that he first thought of the adhesive power ; consequently, as I have already

Supra, 582. shown that Professor Wheatstone was not in possession of any such results until after the unfavourable conclusion of the experiments made by the parties jointly, it must follow that he did not think of his adhesive alarum till after the conclusion of those joint experiments ; and, as I have also shown that Mr. Cooke's alarum was imparted to Professor Wheatstone immediately after the conclusion of the joint experiments, it is a further necessary consequence that Professor Wheatstone was made acquainted with the attractive alarum before he thought of proposing the adhesive one.

624. 2dly. Professor Wheatstone proceeds to state that
Wheatstone's Case, 304, 305. he was the first to propose an independent alarum for the Galvanometer Telegraph ; and he mentions the fact of his having used a musical box for it, in consequence of his finding difficulty in procuring a

625. bell-alarum ready made for the experiment. This experiment of Professor Wheatstone on the alarum took place towards the end of the experiments on the London and Birmingham Railway. He will not deny that his permutating key-boards had been

previously experimented with for some time on the railway, without any arrangement for attaching an alarum to them; and the key-boards themselves, which, happily, I am able to produce, will show the additions which were afterwards made, at a very late period, for the purpose of attaching an alarum.

Now, without insisting on the circumstance that the idea of Professor Wheatstone's musical box alarum, as well as all its parts, were most obviously borrowed from Mr. Cooke's mechanical instruments; which not only were provided with alarums, acting on precisely the same principle, but were also themselves constructed on the principles of a musical box; without dwelling on the resemblance between Professor Wheatstone's statement in his case that he used a musical box, because there was a difficulty in obtaining an article ready made, which may be had, ready made, at every bell-hanger's in London; and his statement in his letter, that he ceded to Mr. Cooke the priority in the Scotch patent, after discussions and fresh arrangements, because there was not sufficient time to fill the names of the parties into a second ready prepared form of the declaration; I answer, that it is a fact which will be proved, not only by Mr. Cooke, but by Mr. Lane, and also by documentary evidence, and which I should suppose will not be disputed; that several months before the date of Professor Wheatstone's experiment with the musical box, Mr. Cooke had not a mere experimental

626.

Cooke's Case,
35—37.Wheatstone's
Case, 274.Cooke's Case,
154—156.
627.

Cooke's Case,
54—55.

628.

musical box, but a practical independent working alarum, belonging to the Galvanometer Telegraph, made by him (as mentioned in his case) in the course of his preparations for his patent; nay, this independent alarum worked with a secondary circuit; it had been shown, together with its secondary circuit, to the Solicitor General, in May, and was actually and practically at work in the experiments on the London and Birmingham Railway for some time before Professor Wheatstone brought thither his musical box. So much for Professor Wheatstone's unmeaning claim to have been the first to propose an independent alarum for the Galvanometer Telegraph. But after all, what would the claim amount to if admitted? His musical box alarum was not an adhesive one; so that the utmost he could claim would be the merit of separating Mr. Cooke's invention into two parts, while in his latest instruments he has found it himself the best and most convenient plan to adopt Mr. Cooke's arrangement of March 1836, by having the whole telegraph compactly included together in the same instrument.

630.

Wheatstone's
Case, 306—
315.

3dly. Professor Wheatstone proceeds to give a long account of the invention of the secondary circuit, showing that it went through various stages; that many different contrivances and modifications were made by both parties in their experiments upon it; that it was claimed by both parties, and thought of great importance by both parties. Now, Gentlemen, let me ask you to ob-

631.

serve that *it cannot be pretended that the secondary circuit has been ever once down to this day used for any invention of Professor Wheatstone's whatever. It was used for Mr. Cooke's mechanical telegraph, and Mr. Cooke's attractive alarum, and for them alone.* I repeat, it cannot be pretended by Professor Wheatstone himself, that it was ever once used for any thing else. Again, Professor Wheatstone's own case, in connexion with Mr. Cooke's letter of the 25th April 1837, to which it refers, and the other letters which will be produced, will prove to your perfect satisfaction (should it be disputed, which I scarcely anticipate), that the secondary circuit was first thought of, after, and in consequence of, the joint experiments on the electro-magnet. Observe then, the inevitable conclusion; the secondary circuit has never been applied to any thing but Mr. Cooke's practical inventions; it was not thought of till after those practical inventions had been confided to Professor Wheatstone, and it *was* thought of (by whichever party) in the course of the joint experiments on those practical inventions: *consequently it was for those practical inventions, and not for any unapplied and condemned proposals of Mr. Wheatstone's, that it was (by whichever party) invented.* In a word, supposing that I should even admit all that Professor Wheatstone's case states upon the subject, the secondary circuit would still be most evidently a partial solution of the scientific difficulty which Mr. Cooke had submitted to Professor

632.

Wheatstone's
Case, 308—
310.

633.

634.

Wheatstone, and not a separate invention of Professor Wheatstone's for any different purpose.

635. But again, as Professor Wheatstone has thought the secondary circuit deserving of a long description and a particular claim, it may not be out of place to prove to you that Mr. Cooke is entitled to a perfect originality in the invention of it, if not to the actual priority. His letter of the 25th April 1837, which Professor Wheatstone has brought forward and adopted in his case, purports to have been written in pursuance of an express arrangement, and was allowed to pass uncontradicted. Now it gives several dates, written when the circumstances were fresh in the recollection of the parties, and which Professor Wheatstone would not have allowed to pass if unfairly stated. Two of
637. the most important dates thus stated are the following :—

636.
Wheatstone's
Case, 310.

16th March.—On this day, Professor Wheatstone first mentioned that he had found out a means of obtaining the required power, on which occasion Mr. Cooke mentioned that there were two means; but neither party entered into particulars: and

18th March.—When Mr. Cooke showed Professor Wheatstone his plan, and Mr. Wheatstone then showed Mr. Cooke his.

638. Mr. Cooke's letter of the 25th April reasons

upon the position, inferred from a conversation on the morning of that day, that Professor Wheatstone claimed the secondary circuit on the ground of his having mentioned generally, on the 16th March, that he had found out the means of obtaining power, and Professor Wheatstone never intimated that his claim rested on any other basis. Now Mr. Cooke's first plan (that which he showed 639. to Professor Wheatstone on the 18th) is the plan Supra, 584. which you will find particularly recorded and sketched in Mr. Cooke's letter to his family of the 14th March, and bearing a post mark of that date, and which has only recently been obtained from the country since the commencement of this arbitration; consequently I am prepared to make out by clear documentary evidence an actual priority of at least two days in Mr. Cooke's favour.

Once more; Professor Wheatstone is incorrect 640. in stating that he first made the secondary circuit Wheatstone's Case, 311. effectual by employing a needle vertically suspended with one permanent contact. The secondary circuit never answered well, but such as it was, it was used with *two* vertical contacts, as described in December 1837 in the first specification, until superseded by Mr. Cooke's substitution 76. of the direct blow of a magnetic needle, as described in the second specification in October 1838. Mr. Kirby (Mr. Cooke's mechanician) will prove 641. that the only discharger which ever had the vertical needle with permanent contact was an instrument on the Great Western Railway, which, being of the

- old construction, continued to use the secondary circuit, even after Mr. Cooke had superseded its general use. Mr. Kirby will also prove that in June 1839, nearly a year after the secondary circuit had been superseded, this single old instrument was observed to work very defectively with its two contacts ; and that Mr. Kirby, for the special purpose of remedying that particular defect, then, by Mr. Cooke's direction, for the first time applied in that single instance to the vertical discharger the principle of a permanent contact ; which, as a principle applied to other purposes, had occurred repeatedly in Mr. Cooke's earliest instruments, as well as in the horizontal discharger mentioned in his letter of the 25th April 1837. Throughout his case, Mr. Wheatstone prudently avoids committing himself to dates : but when he produces the drawings, in which he says his single contact is represented, I must expect him to prove at what date they were made ; and should it appear that he really did think of applying a permanent contact to the vertical discharger at a comparatively early date, I must call upon him to explain why he kept it back and allowed all the instruments to be made on an inferior principle.

644. Professor Wheatstone mentions particularly that the discharger which acted by the decomposition of water was wholly his invention. Though not worth mentioning at all, it was *not* his invention, but an improvement upon an invention of Mr. Cooke's, as will appear by the evidence.

Lastly. Professor Wheatstone is again wrong in saying that the secondary circuit of the alarum was superseded by his improved magnets. It was superseded a year before they were discovered by Mr. Cooke's substitution of the direct action of the magnetic needle, as described in October 1838, in the second specification, and as acting at this day to perfection on the Great Western and Blackwall Railways.

645.
Wheatstone's
Case, 314, 315,
Cooke's Case,
76.

The simple fact is, that Professor Wheatstone has acted in the case of the alarum as the first specification proves him to have acted in the case of the detector; as documentary and other evidence will prove him to have acted in the case of the decomposing apparatus; as he acted in the instance of the intermediate apparatus, which I shall presently come to; according to the practice most usually, and indeed, habitually adopted by him with regard to this Electric Telegraph, viz.: after he had seen Mr. Cooke's practical attractive alarum he proposed a modification of it, and then, first covertly, and afterwards openly, claimed the whole as his own.

646.

In leaving this subject I must observe that, although the invention of the secondary circuit is now no longer worth contending for, the facts elicited by the discussion of it are of the greatest importance in furnishing a link in the chain of evidence, which I advance to prove that every material statement of Professor Wheatstone's has been written with the greatest disregard of consis-

647.

tency and fact, and with an apparent probability in most cases of being beyond the reach of counter-evidence.

648. I now come to a part of his case in which Professor Wheatstone's insinuations assume the less offensive form of direct though serious charges. He tells you that "during his connexion with Mr. Cooke, the latter has not to his knowledge employed himself in inventing anything new, or in making any real improvements on what Professor Wheatstone has done, but has confined himself to closely following his steps, making mechanical alterations in what he has suggested, and complicating instead of simplifying his arrangements." He adds, that "he is unwilling to ascribe motives to Mr. Cooke for so doing, and must leave the facts to speak for themselves." After this courteous introduction, he proceeds to make four specific charges against Mr. Cooke, which I shall state *verbatim*, and answer one by one. The first is as follows:—
- 649.

Wheatstone's
Case, 317.

"After I had succeeded in perfecting my Magnetic Needle Telegraph, and he (Mr. Cooke) had despaired of his chronometric instrument, instead of immediately adopting mine, he went to considerable expense in constructing a Magnetic Needle Telegraph, which did not advance the subject beyond what had been previously done on the Continent."

650. The telegraph here alluded to was Mr. Cooke's second Galvanometer Telegraph, a correct history and description of which are contained in his case

and drawings. It was made to be shown to the Solicitor-General with Mr. Cooke's mechanical instruments, as the complete practical instruments, for which the patent was to be obtained ; and so far from its having been made after Professor Wheatstone had a complete telegraph, *it was shown to the Solicitor-General, as a complete practical working telegraph, in May 1837, together with a pasteboard model of Professor Wheatstone's diagram, hastily made by Mr. Cooke for the purpose, very soon after Mr. Wheatstone invented it ;* indeed it was only by being engrafted on Mr. Cooke's Practical Galvanometer Telegraph that Mr. Wheatstone's diagram and permutating keys assumed the form of an Electric Telegraph at all. Moreover, Mr. Cooke's second Galvanometer Telegraph and his mechanical instruments were at work alone at the London and Birmingham Railway before Professor Wheatstone had even a model instrument to add to them. Professor Wheatstone is most unfortunate in thus attempting, in the teeth of abundance of facts and evidence, to convince you that Mr. Cooke's second Galvanometer Telegraph was made after he himself had "succeeded in perfecting his Magnetic Needle Telegraph ;" I shall disprove this assertion, most fatally to his credit, by a letter of his own, and by a mass of other evidence. Let him, on the other hand, come forward with his mechanician's bills for "perfecting" his Magnetic Needle Telegraph, *or rather for making a working model of it.* I defy him to prove that he had anything deserving the

Cooke's Case,
54, 55.
Drawing IV.,
Part H.

Cooke's Case,
49, 50.

651.

name of a telegraph until after the date of Mr. Cooke's second Galvanometer Telegraph.

652. II. I proceed to the second charge, which is thus stated :—

Wheatstone's
Case, 318.

“Compelled to acknowledge the superiority of my invention, and to relinquish his own imperfect instrument, he set himself to modify my permutating key-board; and without changing the principle, he made a complicated mechanical alteration, which also he was obliged to abandon.”

653. Mr. Cooke is provided with equally clear proof on this subject also. During the experiments on the London and Birmingham Railway, Mr. Robert Stephenson asked Mr. Cooke whether the keys could not be so arranged as to have the signals marked upon them. In consequence of this suggestion, Mr. Cooke made the “modification” referred to, which I shall presently produce. Instead of being “a complicated mechanical alteration,” it is an extremely simple key-board, in which the arrangement of the keys is “symmetrical” with the signals on the diagram.
654. It will be proved by Mr. Kirby and Mr. Moore, who made it, that this “complicated” and abandoned “modification” was at work for several months on the London and Birmingham Railway; in fact, from the 15th July 1837, the time it was made, till the instruments were finally removed, on the 16th January 1838; and I shall also prove to you, both by Mr. Kirby's testimony, and by other conclusive evidence, that

towards the end of the experiments, Professor Wheatstone appropriated even this invention, unimportant as it was, and modified it into the form which he calls his symmetrical key-board, and which he claims in his case as his own original invention. Wheatstone's Case, 292.

III. The third charge is as follows :—

655.

“For instruments at intermediate stations it is convenient to have a means of communicating in either direction at pleasure; and this being a matter of mechanical detail, there are many means of effecting it. I proposed a simple and efficient plan, represented in the diagram which I submitted to Mr. Cooke at the time the experiments were being made on the London and Birmingham line; when, however, some time after, the thing was actually required on the Great Western line, without consulting me, Mr. Cooke adopted another arrangement, which possesses no advantage over mine, while the principle remains necessarily the same. The intermediate apparatus was merely alluded to in our first patent; in the second patent, which was taken out by Mr. Cooke separately, because I objected to it as unnecessary, he has described the arrangement he adopted. By sinking my proposal, and putting forward only his own, a person ignorant of the facts would be led to the conclusion that the contrivance for the intermediate apparatus was an original idea of his, contrary to the fact.” Wheatstone's Case, 319.

656.

657.

This statement with regard to the intermediate apparatus, is that which I have already alluded to as the only part of the case which can bear a comparison with Professor Wheatstone's claim to the alarum. I cannot speak of it in more measured terms than as a most unprincipled attempt on Pro- 658.
Supra, 616.

fessor Wheatstone's part, to appropriate to himself, by the weight of his name (under a mistaken supposition that the statements of the parties would be the only evidence adducible on a subject apparently confined to their own breasts), a part of the invention which I do not hesitate to state plainly in his own presence his conscience tells him at this moment that he has not the shadow of a claim to.

659. I must call upon him to explain before the Arbitrators what his simple invention really is. I do not believe he can now describe any intermediate apparatus, applicable to the Galvanometer Telegraph with five wires, and less complicated but equally efficient with Mr. Cooke's specified plan; indeed, though Mr. Cooke's intermediate apparatus displays very great ingenuity, it is also remarkably comprehensive and simple.

660. The charge itself will be answered by the following evidence:—

Mr. Hoppner will prove that in March 1836, in Germany, within the first week after Mr. Cooke took up the Electric Telegraph, intermediate communication was an important feature in his general plan.

661. In July 1836 Mr. Cooke entered in his pamphlet (which I shall produce) into some explanation of his intended intermediate apparatus, with reference especially to a Government Telegraph, to which he proposed to give the power of cutting off, at pleasure, all communications with the terminus beyond it, and of substituting itself for a time as the terminal apparatus in its stead.

On the 27th May 1837, Mr. Cooke's intermediate principle is explained still more in detail in a letter which will also be produced, bearing a post mark. Here the principle assumes the character of a Police and Fire Telegraph, which, by a single metallic circuit, was to connect the different police and fire-engine stations in the Metropolis. Under the advice of friends, whose letters will be produced, Mr. Cooke laid this aside for the time, as it could have been laid down only by disturbing the pavement; but it is remarkable that the principles explained in the letter of May 1837 strikingly resemble the telegraph now in use on the Blackwall Railway, where five distinct instruments are required to act in concert with each other. Mr. Hoppner's evidence, the pamphlet and the letter, are all long before the date fixed by Professor Wheatstone as that of his unapplied idea. 662.

After the date of it, drawings and models of the intermediate apparatus were prepared by Mr. Cooke, and by Mr. Farey under his instructions, and it formed a subject of discussion between Mr. Farey and Mr. Cooke on several occasions: *Professor Wheatstone being sometimes present, but never once intimating to Mr. Farey, or to any one else, that he had any claim to the intermediate apparatus, or indeed anything to do with it. Mr. Farey will prove this.* 663.

BUT, GENTLEMEN, I HAVE THE MOST STARTLING FACTS STILL IN RESERVE. Observe Professor Wheatstone's words: "When the thing was actually re- 664.
Supra, 656.

quired on the Great Western line, without consulting me, Mr. Cooke adopted another arrangement.'

"In the second (English) patent, which was taken out by Mr. Cooke separately, he has described the arrangement he adopted," "By sinking my proposal and bringing forward only his own, &c."

665. Now, long before the intermediate apparatus was required for the Great Western Railway, before one yard of wire had been laid down on that railway, *nay, more than six weeks before the date of the preliminary agreement with the Great Western Railway Company, under which the experimental application of the telegraph, to a part of their line, was afterwards undertaken, Mr. Cooke's intermediate apparatus was alone described, drawn and recorded in the specification of Messrs. Cooke and*
666. *Wheatstone's joint Scotch patent, enrolled at Edinburgh about the 12th April 1838.* This specification was a considerable time in progress; and I am prepared to prove that, on other occasions, when both parties had something to specify, Professor Wheatstone disregarded every other consideration in his eagerness to have every idea of his own specified first. I am prepared to prove that * * * *

[*Here follows a statement of certain expected evidence of Mr. Farey; which, as Mr. Farey was not examined before the Arbitrators, and as his death has prevented a reference to him for confirmation or disproof of a statement made on his authority, is in fairness struck out.*]

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Such having been Professor Wheatstone's principle 667.
of action in other similar cases, did he act thus in
the case of the specification of the intermediate
apparatus in April 1838, under the first Scotch
patent? Did he show himself to be as eager to
bring forward his "simple and efficient plan" in
that case, as he evidently was to bring prominently
and exclusively forward every plan or idea of his
own, whether efficient or not, in all other cases?
Let him prove that, to any human being, he dropped
the slightest hint of his wish or ability to add to
Mr. Cooke's complete practical specified plan any
other plan whatever for an intermediate apparatus,
or any invention or improvement connected with it.

About the date of the Scotch specification, indeed 668.
for some time both before and after that date, Pro-
fessor Wheatstone was conducting a long-continued
opposition to Mr. Davy's application for a patent.
In the course of the opposition, he brought Mr.
Cooke's intermediate apparatus before the Solicitor-
General, but he cannot say that he brought forward
any other intermediate apparatus.

Gentlemen, I blush to mention one more proof 669.
respecting the intermediate apparatus. *Professor*

Supra, 657.
Wheatstone's
Case, 321—
319.

670.
Supra, 656,
657.
Wheatstone's
Case, 319—
321.

671.
Supra, 665.

Wheatstone has charged Mr. Cooke with a no less offence than that of pirating his invention and (I might almost say criminally), specifying it with unessential modifications as his own. He tells you that, WITHOUT CONSULTING HIM, Mr. Cooke specified his own contrivance, SUPPRESSING Mr. Wheatstone's prior invention. A most serious charge, if true! but if untrue, what can you say of the conduct of the eminent philosopher, who, forgetting that the weight of his name cannot give currency even to private conversations, if inconsistent with circumstances, has advanced, not one or two mistaken statements, but a system of injurious misrepresentations, at direct variance with recorded documents, to which he might have referred? Observe the words; "WITHOUT CONSULTING ME, Mr. Cooke adopted another arrangement." "In the second patent, which I objected to as unnecessary, he has described the arrangement he adopted. BY SINKING MY PROPOSAL AND PUTTING FORWARD ONLY HIS OWN, A PERSON IGNORANT OF THE FACTS WOULD BE LED TO THE CONCLUSION THAT THE CONTRIVANCE FOR THE INTERMEDIATE APPARATUS WAS AN ORIGINAL IDEA OF HIS, CONTRARY TO THE FACT." Now, bearing in mind the fact that Mr. Cooke's intermediate apparatus had been specified under a joint Scotch patent, six months before Mr. Cooke specified the same invention under the second English patent, and therefore that the separate English specification was in fact a transcript, with unessential additions, suggested by six months' experience, from the joint

Scotch specification ; IT IS A STILL MORE ASTOUNDING 672.
 FACT, THAT NOT ONLY ON THE SAME DAY (THE 18TH
 OCTOBER 1838) ON WHICH MR. COOKE IS CHARGED
 WITH ACKNOWLEDGING HIS PIRATICAL ENGLISH SPE-
 CIFICATION BEHIND PROFESSOR WHEATSTONE'S BACK,
 BUT, AT THE VERY MOMENT OF TIME AT WHICH IT
 WAS ACKNOWLEDGED, PROFESSOR WHEATSTONE WAS
 ACTUALLY PRESENT WITH MR. COOKE FOR THE
 PURPOSE OF ACKNOWLEDGING SIMULTANEOUSLY THE
 SPECIFICATION OF A JOINT IRISH PATENT, WHICH
 EMBODIED ALL THE VERY SAME MATTER, WORD FOR
 WORD, AND WAS ACCOMPANIED BY EXACTLY SIMILAR
 DRAWINGS ; EVERY SHEET OF WHICH DRAWINGS WAS
 SEPARATELY SIGNED BY MR. WHEATSTONE HIMSELF,
 LEISURELY, AT HIS OWN HOUSE ; I HAVING, PREVI-
 OUSLY TO THE ACKNOWLEDGMENT, CALLED UPON HIM
 THERE SPECIALLY FOR THE PURPOSE, AS I WILL PROVE
 BY MY BOOKS. Yet neither to Mr. Cooke, to Mr. 673.
 Farey, to myself, nor to any one else, did Professor
 Wheatstone drop the slightest hint of his having
 any claim to, or concern in the intermediate ap-
 paratus, or of his being in possession of any differ-
 ent arrangement of it.

These, Gentlemen, are the circumstances under 674.
 which Professor Wheatstone now claims the inter-
 mediate apparatus as his own, and attempts to make
 out his claim by undermining Mr. Cooke's charac-
 ter. I prove that the intermediate apparatus was
 invented by Mr. Cooke before he knew Professor
 Wheatstone ; that it stands recorded as the only
 intermediate apparatus in a joint Scotch specifica-

tion, of a date prior to the agreement for the Great Western Railway experiments; and that, instead of having been specified in England without Mr. Wheatstone's knowledge, it was specified there as the only intermediate apparatus, in his presence, and with his concurrence, in a form sanctioned and

675. ratified by his signature. It is also worthy of remark, that even a year later, in preparing for the specification of the last patent, Mr. Wheatstone knew so little of the principle of the intermediate apparatus, that he could not apply it properly to his new instruments, but involved it in a labyrinth of unnecessary wires, from which Mr. Cooke had to extricate it; and he did not even attempt the portable apparatus, though only a simple but very important development of the same principle. This will appear by a finished drawing, which Professor Wheatstone has and can produce.

676. Gentlemen, it must be the wish of every well-regulated mind, that unprincipled insinuations should recoil upon the party who advances them. But let me remind you that, but for the difficulty of making unfounded assertions consist with circumstances, Professor Wheatstone's statement might, in this instance, have probably been incapable of disproof. *As it is, they must stand recorded instances of Professor Wheatstone's deliberate and systematic attempts to give currency, by the weight of his name, to injurious insinuations, resting upon assertions which have no foundation in fact.* They placed Mr. Cooke on the brink of a precipice; for

if believed, they would have ruined his character, and also (as a minor evil) they would have put it out of his power to find a partner in another invention, which he has at this moment in his view. Now, as Professor Wheatstone would not have thrown out his insinuations unless he expected them to be believed, he is answerable for these injurious consequences just as if they had actually occurred; and the Arbitrators are equally bound, as I respectively submit, to vindicate Mr. Cooke's character, in the most complete manner, from the foul aspersions wantonly attempted to be thrown upon it.

IV. There is only one remaining charge against Mr. Cooke, and it is one which you will find to be not only equally unfounded with his other charges, but also in itself of so frivolous a nature, as not to deserve an answer of any kind, *had not Professor Wheatstone brought it forward as the instance in which his rights and feelings have been, as he says, the most disregarded by Mr. Cooke.* It is thus recorded in his case :—

“The case, however, in which I considered Mr. Cooke acted with the greatest disregard of my rights and feelings, was the following :—As I have said before, the Magnetic Needle Telegraph, with permutating circuits and characters indicated by the convergence of the needles, is an invention exclusively and entirely my own, and rendered by me complete in all its details. This was emphatically ‘the Telegraph,’ and if any person had asked who was its inventor, my name alone could be mentioned. Yet Mr. Cooke was, it appears, unwilling that this merit should be ascribed

677.

678.

Wheatstone's
Case, 322—

329.

Cooke's Case,
126—128.

679.

- solely to me, and with the view, as I am compelled (though reluctantly) to believe, of justifying the association of his name with mine on the instruments in question, he made a different disposition of the keys, but one in which the simplicity and symmetry of my arrangement was destroyed,
680. while no advantage whatever was obtained. This done, he placed his name first on all the instruments, giving the erroneous impression to the visitors of the railway, that he had not only a share, but the most important share, in
681. their invention. What I conceive justifies my view of this transaction is, that though by an express stipulation in our agreement, I should have been consulted on any proposed modifications in the instruments, and possessed the right of objecting to them, my opinion was never asked on the subject, and all the instruments for the railway were finished before I knew that any alterations were contemplated. I expressed my strong disapproval of these alterations; but as great expense had been incurred, I could do no more.
682. When I remonstrated with Mr. Cooke, on his placing his name prominently first on my instruments, he promised that the cause of complaint should be removed; but he said, that as it would not look well to have the change made all at once, he would, when a new instrument was made, substitute it for the one at Paddington, and afterwards do the same with the others. I was satisfied with these promises; but the substitutions have never been
683. made, and the instruments since placed on the Blackwall Railway are on the same construction, and have also Mr. Cooke's name placed first.

684. It must afford some gratification to Mr. Cooke, to find that, notwithstanding the unhappy differences which have arisen between his partner and himself, he cannot, after four years' connexion, be charged with any crime of a deeper dye than that of having followed the universal practice of patentees,

in placing the names "Cooke and Wheatstone" in the same characters, and in the same line, on instruments which were alone secured by two patents, in the first of which his own name took the lead, and in the second stood alone, he being also the managing partner, under a partnership deed settled *Supra*, 561. by arbitration and in which also his name took the lead.

Pray, Gentlemen, observe the case in which Professor Wheatstone considers that Mr. Cooke "acted with the greatest disregard of his rights and feelings," by putting upon the joint instruments 685.

"COOKE AND WHEATSTONE."

"Patent, 12th June 1837, and 18th April 1838."

An offence committed two years ago, and finally discontinued the moment Mr. Cooke was informed that his partner disapproved of his name being used!

But though the charge itself is frivolous in the extreme, there is an insinuation implied in it which requires to be exposed. Professor Wheatstone charges Mr. Cooke with making "a different disposition of the keys," "with the view of justifying the association of his name with Professor Wheatstone's" on instruments which were "emphatically the Telegraph," and with regard to which "Mr. Wheatstone's name alone could be mentioned" as the inventor's. 686. *Supra*, 679. *Ibid.* 678.

Mr. Cooke neither required nor sought for any thing to justify his following the arrangement of 687.

Cooke's Case,
67; also 61—
64.

names used by Mr. Wheatstone himself, on the formation of the partnership in May 1837, in a document which I will presently lay before you, as well as in the patents and partnership deed, by making the partnership firm "Cooke and Wheatstone," and not "Wheatstone and Cooke." It cannot be supposed that the "different disposition of the keys" was made for the purpose of justifying Mr. Cooke in a thing which evidently required no more justification than the signature of any other partnership firm; and besides, Mr. Cooke had before placed the names "Cooke and Wheatstone" on instruments having Professor Wheatstone's exact keys; and also I shall prove, by the instruments about to be received from Berne, that the principle of Mr. Cooke's keys had been conceived by him at Heidelberg, two years before he adopted them at Mr. Brunel's request on the Great Western Railway, and one year before he knew Professor Wheatstone; therefore, in no possible point of view, is there any ground or reason for suspecting that Mr. Cooke made his new keys for the purpose so unhandsomely and gratuitously supposed by Professor Wheatstone.

689.
Supra, 681.

Mr. Wheatstone is equally unfortunate in charging Mr. Cooke with having infringed an express stipulation in the partnership agreement, in not consulting him before the modified keys were adopted in the instruments for the Great Western Railway. There certainly is a general clause in the partnership deed, to the effect that in cases not sufficiently

provided for by the specification the best mode of constructing and applying the patent instruments shall be adopted, and also that it shall be from time to time made the subject of agreement between the parties, so far as the choice may rest with them and not with licensees or purchasers. But the “express stipulation” in this clause, even supposing it to comprehend modifications in minute practical details, was not in any way infringed ; for not only were Mr. Cooke’s keys used at Mr. Brunel’s express desire, as being easier to work, but they were also made according to accurate detailed drawings, represented and described in the Irish specification, to which Professor Wheatstone was a party, on the 18th October, 1838. 690.
 Infra, 695, 696.

There are a few minor statements connected with Mr. Cooke’s keys which cannot be passed over in silence. They are thus entered in the case : 691.

“All the instruments for the railway were finished before I knew that any alterations were contemplated. I expressed my strong disapproval of these alterations ; but as great expence had been incurred, I could do no more.” 692.
 Wheatstone’s Case, 326.

And again, in his claims to the separate privileges : 693.

“The principal reason for my claiming it” (the privilege of manufacturing his new instruments) “was, as I told Mr. Cooke at the time, to prevent in future alterations being made by him or others in my instruments without consulting me, and against my wishes, as had previously been done in the case of the instruments on the Great Western Railway.” Ibid. 388.

694 Here, gentlemen, you have *another specimen, galling indeed to Mr. Cooke's feelings, though not perhaps very important in itself, of Mr. Wheatstone's mode of reporting private conversations, apparently incapable of independent proof. But in this, as in other instances, he will find that ex parte reports of the most private conversations may refute themselves by their inconsistency with circumstances.*

695. *After some of the Great Western Railway instruments were made, but a considerable time before all of them were made, Mr. Cooke's keys were accurately described and drawn in the joint Irish specification already referred to, and which was signed, sealed and acknowledged by Mr. Wheatstone himself on the 18th October 1838, each sheet of the drawings for it having been previously separately signed by himself leisurely at his own house, where he was*
 Supra, 672. *specially called upon for the purpose.* Considering then that the drawings thus signed by Mr. Wheatstone included two large and conspicuous and three minor drawings of the new keys, does not Mr. Wheatstone show a positive want of respect towards the Arbitrators, in asking them to believe that he never heard of these modifications till long after ?

697. In consequence of Professor Wheatstone's objection to his name being placed on the instruments, Mr. Cooke good-humouredly agreed to discontinue the practice of putting the names upon them ; and he also said, that should new instruments be substituted for the old ones on the Great

Western Railway, or should the old dials be repainted, he would drop the names: but the original instruments have remained as they were to this day, and no new ones have been made.

The statement that "the instruments since placed on the Blackwall Railway are on the same construction, and have also Mr. Cooke's name placed first," forms a very proper conclusion to this (I must repeat it) most frivolous charge, as will appear by the following facts. 698.
Supra, 683.

On the 11th December 1839, Mr. Cooke proposed, in a letter of that date, to try Professor Wheatstone's new instrument, in any way the latter might wish, "on the Great Western and Blackwall lines and elsewhere as opportunity should offer." 699.

Soon afterwards Mr. Cooke bespoke two of Mr. Wheatstone's new instruments for the Blackwall Railway, and advanced 15*l.* for them. 700.

After several communications on the subject, Mr. Wheatstone wrote Mr. Cooke a letter, intimating that the instruments themselves were made, but that Mr. Wheatstone wanted a few pounds to complete the cases. 701.

Immediately on receipt of this letter, Mr. Cooke sent Professor Wheatstone a check for 35*l.*, as full payment for the instruments. 702.

On the 19th April 1840, Mr. Wheatstone wrote Mr. Cooke a letter of that date containing the following passage: "I duly received your check for 35*l.* which, as it was crossed to Messrs. Scott & Co. 703.

I did not think required a receipt. Immediately it arrived I put in hand the cases, which are just finished, and look very well ; and the pair of new instruments will be ready when I can get the third magnet, which is still wanting to complete them. I expect to be able to try them on the Great Western line, and to forward them to you in about a week."

704. The instruments, though again more than once applied for, have never been received by Mr. Cooke down to this day.

705. After the opening of the Blackwall Railway, the Chairman of the Company expressed dissatisfaction to Mr. Cooke at the proper instruments not having been put upon their line, and requested that they might be fixed immediately ; and, in consequence, two old portable instruments were borrowed for the time from the Great Western Railway, and very hastily fitted up, with pieces of paper put over those of the characters on the dial which did not suit their temporary office ; and these two old instruments, the property of the Great Western Railway Company, are the only two out of 19 distinct instruments on the Blackwall line, on which the

706. names appear, or ever have appeared. Moreover, 15 out of these 19 are not, as Professor Wheatstone states, upon the same construction as those on the Great Western Railway, but are, on the contrary, of a construction which is entirely, or almost entirely, Mr. Cooke's sole invention. *And here I close the list of Professor Wheatstone's charges and*

insinuations, deliberately brought forward upon assertions which can be proved to be untrue; assertions made in the most positive manner, without inquiry, and in open defiance of recorded and conclusive proofs, to which reference might have been made.

Professor Wheatstone has not only acted un- 707.
generously in the charges he has made against Mr. Cooke, but his conduct in this respect has also been most injudicious; for had he treated Mr. Cooke with even moderate fairness, he might have retained the undisputed possession of the scientific department of the invention. The course he has 708.
adopted will force me to prove that it is by Mr. Cooke, and not by him, that the practical scientific difficulties have been for the most part overcome. For, without recurring to the con- Supra, 584.
clusive evidence by which it can be shown that Mr. Cooke might claim the original authorship of the new magnet, I am prepared to show that his practical labours have not been confined to the "laying down of the lines," though even there his long-continued and now successful exertions to maintain the insulation of the wires, and to provide for the effects of changes of temperature and other disturbing agencies, might well deserve to rank as practical scientific experiments. I am prepared, I say, to show that Mr. Cooke has done practically as much as Professor Wheatstone, even in the strictly scientific department. For example: it 709.

was Mr. Cooke who first recommended and used the very minute wire which answers so well for the galvanic coils and voltaic magnets; it was Mr. Cooke who first discovered by experiment how much the battery might be reduced in size, and his diminutive battery was used by Mr. Wheatstone for numerous experiments upon the London and
 710. Birmingham Railway; it was, I believe, Mr. Cooke, who was the first in this country to try the porous ware now so commonly used for batteries. For I have a note from Mr. Davenport, which accompanied an ordered specimen of that substance, as early as the 9th of September 1837; and, though I speak under correction, I believe it will be found that no other person used it for batteries till considerably after that date.

711. I now conclude the subject of the Galvanometer Telegraph, by begging once more to remind you that the subject on which I have had the honour of addressing you *stands at this moment recorded as an invention secured by two English patents, in the first of which Mr. Cooke's name takes the lead, and in the second stands alone; as an invention in which Mr. Cooke's name took the lead in England in June 1837, in Scotland in December 1837, and in Ireland in April 1838.* It is also worthy of notice,
 712. that Mr. Cooke having indisputably *on some grounds* claimed and obtained priority of names, pecuniary advantages, and exclusive engineering privileges, with regard to the invention generally; Professor

Supra, 546—
 559.

Wheatstone, on becoming at a later date the immediate agent by whose improvements the mechanical form of telegraph was advanced from its former inferiority to a high and valuable rank in the invention, asked, and partially obtained, several minor privileges of a similar description with regard to it; that is, Professor Wheatstone himself acted at a recent date, as if he considered that privileges like those which Mr. Cooke always possessed, but which he himself had never before even claimed or asked, ought in a measure to follow an important practical advance which he had made in the invention. It appears to me that Professor Wheatstone's priority in the third English patent, his separate privileges, and the 100*l.* allowed him for his experiments, amount to a very strong confirmation of Mr. Cooke's general projectorship.

Cooke's Case,
82—86; also
98.

713.

This subject naturally leads me to a few observations on the existing forms of the Mechanical Telegraph, in other words, on the "new instruments," of which so much has been said. As Mr. Cooke's drawings and tables, which trace the development of the invention step by step, and follow each part of the apparatus through all the different stages in which it appears, will best enable you to judge whether Mr. Wheatstone's forms of the new instruments are an improvement on Mr. Cooke's old Mechanical Telegraph, or an original invention of his own, I shall confine my observations at present

714.

Observations
on the Mechanical
Telegraph.

715.
Wheatstone's
Case, 349.

- to the general principle on which, as it appears to me, your comparison of the instruments ought to be made. Professor Wheatstone states in his case, that "wherever he has borrowed an idea from Ohm, Gauss, Steinheil, or any other person, he has been, and shall always be, ready to acknowledge it;" and he apparently wishes you to consider Mr. Cooke as standing only in the same position, and as entitled only to the same rights, as Ohm, Gauss or Steinheil. To make the cases at all parallel, you must suppose Professor Wheatstone to have become confidentially acquainted with some undivulged invention of Ohm, Gauss or Steinheil, as the inventor's confidential adviser and scientific partner, to have suppressed his client's name, and to be using every endeavour to appropriate to himself the practical invention which was confidentially entrusted to him.
716. Let me also remind you, Gentlemen, that this is not a question among independent philosophers in different countries, disputing for the credit of unapplied scientific theories, *but one between two English gentlemen, who have bound themselves by a solemn legal partnership deed to work out the Practical Electric Telegraph together in this country, and to throw all improvements into their joint-stock.*
717. I must also observe, that it is most illiberal and unworthy of an eminent philosopher to attempt to detract from Mr. Cooke's invention of the Mechanical Telegraph, in March 1836, by stating, as Mr. Wheatstone does now in his case, "that Mr. Morse, of New York, had, in-

Wheatstone's
Case, 344.

dependently of him, employed an electro-magnet for telegraphic purposes," especially if that statement be compared with the extent of Professor Wheatstone's knowledge upon the subject at so late a date as the 2d July 1838, when he writes, "I received Mr. Wilson's note, informing me of the new application for a patent, on Saturday evening, and I called on Carpmael to-day respecting it. He could give me no information; but I have little doubt that it is for an Electrical Telegraph, and that the party applying is Mr. Morse, of New York, *whose experiments on this subject, when he employed only common electricity, have been published in Siliman's Journal.*"

A few words as to Professor Wheatstone's quotations from letters, to prove that Mr. Cooke did not at first consider Professor Wheatstone's new instruments to be founded on his own old ones. This point will depend on the instruments which are extant. Moreover, the simple fact of Mr. Cooke's having sent to Liverpool for his old instruments, and forwarded them on arrival to Professor Wheatstone, superseded any necessity for risking the irritating and unfriendly discussions which might have arisen from claims made in the absence of the evidence. As to a circumstance which Professor Wheatstone has several times urged in his case as "a distinct acknowledgement on Mr. Cooke's part" that the new instruments "were his exclusive inventions," viz., Mr. Cooke's consent that his name should appear alone upon them, he has omitted to

718.
Wheatstone's
Case, 350—
353.

Cooke's Case,
114, 115.

719.

Wheatstone's
Case, 351—
357; also 384.

mention that this right of putting his name alone upon his instruments (his object in asking which is now sufficiently evident) was, in fact, one of those “*conditions*” which his letter of the 26th October confesses to have been proposed and assented to before the experiments were described or the instruments shown to Mr Cooke. And why was it that about half a year elapsed before Mr. Cooke was allowed a sight of the new instruments, though the partnership deed bound Professor Wheatstone by an “express stipulation,” and in the most stringent way, to communicate them immediately? Was it because Professor Wheatstone doubted his liberality? Oh no; for he felt no hesitation in trusting to his liberality for an ample reimbursement of the expences of his experiments. But he well knew that his new instruments so closely resembled Mr. Cooke’s old ones, that he could not expect to obtain his “conditions” at all, unless he could extort them in the dark. And it affords no inference against Mr Cooke, that the letters quoted prove him to have afterwards conscientiously adhered to the promise to which he had incautiously committed himself in ignorance of the real nature of Professor Wheatstone’s improvements. The letter of the 11th of December 1839, mentioned by Mr. Wheatstone, is a very important one; for it was written by Mr. Cooke at Professor Wheatstone’s house, and altered to meet the latter’s wishes; yet it only in a general way admits two points, and those two scien-

Cooke’s Case,
88.

720.

Cooke’s Case,
90.

Ibid. 98.

721.

Wheatstone’s
Case, 351.

tific points, to belong to Professor Wheatstone, viz., the improved magnet and the constant circuit.

Respecting Mr. Cooke's forms of the new instruments, Professor Wheatstone's reasoning is founded entirely on misquotations from Mr. Cooke's letters. Where he introduces the subject by stating that he is about to "take into consideration a demand which appears to him of a most unreasonable character, and which Mr. Cooke has advanced in his letter of October 20, 1840," he ought not to have misled the Arbitrators by misquoting that letter, and attaching to it a meaning which it obviously does not, and, as he well knows, it was never intended to convey. He quotes the objectionable demand in these words: "That I (Professor Wheatstone) should acknowledge the instrument he (Mr. Cooke) has inserted in the last patent to have been not only founded on his old instrument, but to have been invented and worked out independently of me." The following is a correct quotation of the passage referred to: "In the first place, I must expect that the reason why I originally expressed my willingness to give you the separate privileges in question should be clearly explained in the deeds; an explanation which might be to this effect; that you having in progress certain improvements on our joint invention, depending fundamentally upon principles first discovered and applied by me, and since worked out by each of us separately, in forms essentially distinct, both which forms have since been comprised in our third spe-

722.

Observations
on Mr. Cooke's
new instru-
ments.
Wheatstone's
Case, 358.

723

Wheatstone's
Case, 358.

724.

725. Wheatstone's Case, 359, and 364. cification, you asked me as a favour, before you confided to me the nature of your improvements, to waive my exclusive rights, &c." Professor Wheatstone has more than once in his case substituted the word "*independently*" for the word "*separately*," and his whole argument is founded on the former word; whereas he perfectly well knows that Mr. Cooke never pretended to have worked out his new instruments "*independently*," in the sense supposed. He worked them out "*separately*;" for on hearing of the discovery of the laws of the magnet, he immediately conceived "*separately*" a mode of applying it based upon his invention of 1836, but which is the exact converse of the mode borrowed by Professor Wheatstone from the old mechanical instruments; and this invention was agreed to be entered, and was entered, "*separately*" in the specification, in a "*separate*" description, and "*separate*" drawings.
726. And even if there were any want of strict grammatical precision in Mr. Cooke's letter, he did not bind Professor Wheatstone to the exact words used in that letter; on the contrary, he asked "an explanation which might be to a given effect," not which was demanded to be in given words; in short, he only required in his letter what he has since more formally required in the following clause of the agreement of reference: "And he (Mr. Cooke) also claims a right of inserting in recitals in all documents which he may be called upon to sign, in relation to the said separate rights and
727. Agreement of Reference, pages 1 and 2.
- Cooke's Case, 105.
- Supra, 724.

benefits, a clear statement of the grounds expressed by the said parties at the time (whatever grounds really were then expressed), as the grounds upon which the said separate rights and benefits were claimed or asked for by the said Charles Wheatstone, and conceded by the said William Fothergill Cooke."

Again, in quoting Mr. Cooke's letter of the 11th December 1839, Professor Wheatstone has inserted the word "*chronometric*," which is not in the letter, and which completely alters the sense of the passage quoted; for it leads to the supposition that Mr. Cooke was alluding to the instruments which Professor Wheatstone had been before describing as *chronometric* instruments, whereas the allusion was, as Professor Wheatstone well knows, to Mr. Cooke's "*escapement*" instrument of the same date: the remains of which had been brought from Liverpool and left with Professor Wheatstone, and had formed the subject of a long conversation between the parties, and which indeed was the instrument thrice sketched in the drawing of December 1839, to which his own case now refers as an important document. So much for Professor Wheatstone's premises.

728.

Wheatstone's
Case, 361.Wheatstone's
Case, 363.

As to his conclusions, the drawings and tables will enable you to compare the different forms of the Mechanical Telegraph, and Mr. Farey will be called as a witness to explain their essential identity of principle, and also the great practical superiority of Mr. Cooke's last inventions. And here I will

729.

Drawing XI.
and Tables.

leave the Mechanical Telegraph, with this single further observation; that Mr. Cooke certainly deserves credit either for what he suggested, and Professor Wheatstone turned to better account; or for what Professor Wheatstone suggested, and he turned to the best account; whereas Professor Wheatstone claims all in both cases.

730. And now, Gentlemen, if the evidence bears out my statement (as I pledge myself it will), I cannot more properly conclude my appeal to you, than by repeating the expressions of honest indignation which years of systematic injustice drew from Mr. Cooke, in his final appeal to Professor Wheatstone himself, in October last: I MOST WILLINGLY ACKNOWLEDGE THE VERY GREAT VALUE OF YOUR IMPROVEMENTS IN THE TELEGRAPHIC APPARATUS; BUT ADMITTING THESE CLAIMS OF INVENTION TO CERTAIN PARTICULAR FORMS IN A LONG SERIES OF IMPROVEMENTS, THROUGH WHICH EVERY NEW INVENTION MUST GRADUALLY ADVANCE TO PERFECTION,—INDEPENDENT OF THEM ALL,—I STILL MAINTAIN MY CLAIMS ON THIS BROAD BASIS, THAT ALONE, UNAIDED AND UNADVISED, I PROJECTED, AND AFTER FIVE YEARS OF INDEFATIGABLE PERSEVERANCE, AMID THE GREATEST DIFFICULTIES, HAVE NOW INTRODUCED INTO DAILY USE MY OWN PROJECT OF A PRACTICAL ELECTRIC TELEGRAPH: WHICH IN THEORY HAD REMAINED FOR MANY YEARS A PLAYTHING IN THE HANDS OF SCIENTIFIC MEN, AND MIGHT, BUT FOR MY EXCLUSIVE DEVOTION TO IT FROM THE FIRST DAY THAT THE IDEA OCCURRED TO ME, HAVE REMAINED SO TILL THIS DAY.

Cooke's Letter
of October 20,
1840.

IS ANY MERIT THAT MAY BE DUE FOR THIS TO BE CANCELLED OR ECLIPSED, EVEN BY THE MOST BRILLIANT IMPROVEMENTS IN PARTS OF THE APPARATUS EMPLOYED ?”

From the spirit in which Professor Wheatstone's 731.
case is written, it is obvious that a morbid dread of Mr. Cooke's rivalry jaundiced his views of the latter's conduct from a very early period, from which time every little grievance has been hoarded up in his memory, and brooded over till the most trivial circumstances, capable, as I have proved, of the most satisfactory explanation, assumed the form of a serious injury. These points have now been 732.
cleared away, and Mr. Wheatstone may be prepared to view his partner's conduct in another and a clearer light. I can scarcely think that he would have acted as he has if he had made himself fully acquainted with, and deliberately estimated what Mr. Cooke has done; and I still indulge a hope that, with the evidence now before him, he may wish to retrace his steps. If he had adopted a different and more honourable line of defence, Mr. Cooke would have privately given him an opportunity of withdrawing those parts of his case which are inconsistent with ascertainable fact: and even 733.
now, if he proposes to recall his unfounded statements, and to apologize for the insinuations which he has based upon them, and which have so unexpectedly changed the aspect of these proceedings, that manly and honourable course is still open to him; and we may then ask you to examine the

- evidence rather as friends, whose mediation may remove a very serious misunderstanding between the authors of what may one day prove a great national invention, than as judges, to decide whether in this free country it is scientific tyranny alone
734. that is irresponsible and uncontrolled. Otherwise I shall not conceal from you that Mr. Cooke views the line of defence adopted by Professor Wheatstone in his case with a feeling of the strongest indignation ; and I must appeal to you, in conclusion, to execute the duty which, as men of science, as gentlemen and men of honour, you have undertaken, however painful to you the execution of that duty may be. The investigation before you will then admit of no adjustment ; you will have to decide — * * * *

735. [*The concluding passages of my solicitor's address contain severe comments on Mr. Wheatstone's injustice towards me, and on the incorrectness and inconsistency of his statements. I have considered it unnecessary, at this distance of time, to embitter my controversy with Mr. Wheatstone by publishing matter which might give him pain, except so far as it is indispensably required for the elucidation of some question of fact. It is, of course, competent to Mr. Wheatstone to publish the suppressed passages if he thinks fit to do so.*]

[*The Address sums up the evidence as follows:—*]

I now conclude by representing to you, separately and specifically, the

RESULTS OF THE EVIDENCE.

FIRST.

That scientific men having, in several countries 736.
and for many years, directed their occasional atten- March 6, 1836.
tion to the subject of communicating intelligence Cooke's Case,
by means of electricity, without any practically 13.
useful result, Mr. Cooke's attention was accidentally Supra, 504.
directed to the subject about the 6th of March *Evidence.*
1836, when he immediately sacrificed other scien- Mr. Hoppner
tific pursuits to which he was strongly attached, and posted
and in which he had attained a very respectable letters, &c.
proficiency, and has thenceforth, to the present day,
devoted his whole mind time and means to the
realization of the Electric Telegraph, as a practical
and national invention.

SECONDLY.

That within a month after he first took up the 737.
subject, Mr. Cooke, without any acquaintance with March 1836.
the experiments of others, invented a practical Cooke's Case,
system, by means of which the Electric Telegraph 18, 19, et seq.
was realized and organized into a practical invention Drawing I.,
of importance and value; the leading features in Part B.
Supra, 504.
Case 21—24.

which system consist in Mr. Cooke's reciprocal arrangements for qualifying his apparatus to communicate backwards and forwards, and also to exhibit simultaneously, before the different correspondents, a sufficient diversity of practical signals; the arrangements for detecting contacts and injuries to the metallic circuits, and also those for insulating and defending them; and the arrangements for attracting attention by sounding alarums, in a simple, practical, and perfectly original mode: which system forms the basis of everything that has been done in the practical English Electric Telegraph down to the present day, and differs from the scientific researches of others, not only in its own nature and character, but also in its ultimate objects; it being clearly proved that, from the very first, Mr. Cooke was labouring with a direct practical view to railways, commerce, and Government.

Ibid. 20.

Ibid. 25, 26.
Drawing III.
Part C.

Evidence.
Mr. Hoppner,
old drawings,
posted letters,
Mr. Cooke's
pamphlet of
July 1836,
Rev. T. Cooke,
Mr. Moore
and other
witnesses; and
instruments.

738.

1836.

Cooke's Case,
27, and 33—
37.
Drawings, II.,
III., VII. and
XI.

Evidence.
All the mecha-
nical instru-
ments.

THIRDLY.

That the essential principle of the Mechanical Telegraph of every form, namely, that of causing electricity to divide a mechanical motion into a diversity of signals, is entirely Mr. Cooke's original and sole invention.

739.

Cooke's Tables
and Drawings,
by which the
invention is
traced down,
step by step,

FOURTHLY.

That not only is Mr. Cooke's system the basis of every modification of the Practical Electric Telegraph, but also that Mr. Cooke himself conceived,

projected, and more or less worked out, every separate modification of it which has been reduced to practice; and that the latest and most improved forms of the Electric Telegraph, at this day, are only developments of the very forms projected by Mr. Cooke in the spring and summer of 1836.

from its origin
in March 1836.
Evidence.
All the instru-
ments.

FIFTHLY.

That before the end of 1836 Mr. Cooke was engaged in endeavours to introduce the Practical Electric Telegraph in a tunnel upon the Liverpool and Manchester Railway; that such endeavours were disappointed only in consequence of the opening having been pre-engaged; and that the instruments made for the purpose are practical working instruments, now extant, and fitted to perform the office for which they were made.

740.
December
1836.
Cooke's Case,
41, 45.
Evidence.
Letters and
instruments.

SIXTHLY.

That in February 1837 Mr. Cooke had determined to take out a patent for the Practical Electric Telegraph, and only deferred doing so for a time in consequence of his meeting with a single scientific difficulty in the construction of his electro-magnets; which difficulty he submitted, on the 27th of February 1837, to Dr. Faraday and Dr. Roget, and then to Professor Wheatstone, and which had not previously come under their notice.

741.
27 February
1837.
Cooke's Case,
46, 47.
Evidence.
Posted letters,
and Mr. Lane.

SEVENTHLY.

That the circumstance of Professor Wheatstone's having at King's College four miles of wire, which

742.
March and
April 1837.

Cooke's Case, 51—53. he had been using for electric experiments, led to a course of joint experiments between Mr. Cooke and him on the scientific difficulty which Mr. Cooke had met with in the electro-magnet; the result of which experiments being unfavourable, Mr. Cooke immediately afterwards conceived, sketched and described, and communicated to Professor Wheatstone, certain essential modifications in the proportions of the magnet and its coils, as a likely mode of obviating the difficulty; and that Professor Wheatstone, in his recent discovery of the laws of the electro-magnet, has only worked out into a philosophical system Mr. Cooke's original suggestion to him: the secondary circuit having been previously used as a temporary expedient.

Supra, 584.

Evidence.
Posted letters.

EIGHTHLY.

743. That on the 27th of February 1837, when Mr. Cooke first consulted Professor Wheatstone, and when Mr. Cooke had projected the entire Practical Electric Telegraph of both forms, and was on the eve of taking out a patent for his practical invention, Professor Wheatstone had no practical invention of any kind, though he had for many years turned his attention occasionally to telegraphic experiments.

27 February 1837.
Cooke's Case, 48—50.
Supra, 505.
Evidence.
Professor Wheatstone's key-boards; his admissions by letter; Mr. Cooke's posted letters; inferences from probability and conduct.

NINTHLY.

744. That early in May 1837 Mr. Cooke admitted Professor Wheatstone into partnership with him in his practical invention, as his scientific partner, and

May 1837.
Cooke's Case, 56—68.

with a view to his scientific assistance, and on no other ground or footing.

Evidence.
Posted letters;
conduct of
parties; Mr.
Lane.

TENTHLY.

That Professor Wheatstone did not at the time dispute Mr. Cooke's right to the absolute superiority, in every respect, in the invention, but used earnest and lengthened endeavours to prevail on Mr. Cooke to allow his name to stand first in the patent, urging no other argument whatever than the importance of scientific fame to himself, and the comparative unimportance of it to Mr. Cooke; but Mr. Cooke insisted on taking the lead, and did accordingly take the lead; and that Professor Wheatstone was admitted to a half share in the patent, only upon the terms of his paying about three-fifths of the expence of it, and allowing to Mr. Cooke out of the joint proceeds the whole expence of his (Mr. Cooke's) experiments, for payment of which a share in the patent was to be sold; while, on the other hand, for Professor Wheatstone's experiments, though they had been lengthened and expensive, no allowance was made or asked for, they not having been of any practical value; and that Mr. Cooke was afterwards still more solemnly recognised and confirmed as the Projector of the Practical Electric Telegraph, with the entire management and exclusive engineering privileges granted to him on that ground, by a partnership deed, executed under an arbitration, in November 1837.

745.
May, November, 1837.
Cooke's Case, 56—68, and 140—153.

Cooke's Case, 70—72.
Supra, 560.
Evidence.
Mr. B. Hawes, M.P., Mr. Lane, Professor Wheatstone's letters, partnership accounts and agreements.

ELEVENTHLY.

746. That Professor Wheatstone, as scientific partner, has, since the formation of the partnership, made various valuable practical improvements on Mr. Cooke's original invention ; but such improvements are entirely and exclusively developments of Mr. Cooke's invention, as confidentially communicated by him to Professor Wheatstone; and that the same are overbalanced by greater and more important practical improvements, which Mr. Cooke has himself made since the formation of the partnership; and also, that although Mr. Cooke has not interfered at all in the reduction of the Electric Telegraph into a philosophical system, he has since the formation of the partnership exerted himself with great success in obviating scientific difficulties.

Evidence.
Mr. Farey and instruments ; also other witnesses and letters.

Ibid. 73—79, and 105—112. Drawings, VI., VII., VIII., IX. Supra, 707—710.

Cooke's Case, 68, 69, and 102—104.

TWELFTHLY.

747. That the tables handed in by Mr. Cooke, and tracing the apparatus through its various stages, are correct ; and that it appears thereby (as the fact is) that Professor Wheatstone can claim scarcely anything as his original invention, though he has done very much in common with Mr. Cooke in improving the telegraphic apparatus.

Tables and Drawings.

THIRTEENTHLY.

748. That Professor Wheatstone is now convicted by clear evidence, and even by his own admissions, of having acted systematically, ever since Mr. Cooke admitted him into partnership, with the aim and

Evidence.
Professor Wheatstone's

Supra, passim. Cooke's Case, 195—230.

object of supplanting Mr. Cooke, and of appropriating to himself the whole merit of the Practical Electric Telegraph.

Case and letters. Publications before and since the arbitration, and witnesses.

FOURTEENTHLY.

That Mr. Cooke has, on the contrary, acted throughout with the utmost moderation forbearance and liberality towards Professor Wheatstone, and has constantly and in the most gentlemanly and friendly manner appealed to him to correct the misrepresentations, which it now appears, by Professor Wheatstone's own admissions, that he was all the time actively, though covertly, engaged in establishing and confirming; and that it is only after a final unsuccessful appeal to Professor Wheatstone that Mr. Cooke has at length, with the utmost reluctance, appealed to arbitration for justice.

749.

Cooke's Case, 8—10, 82—87, 210—220.

Ibid. 219—221.

Evidence. Letters, publications, and witnesses.

FIFTEENTHLY.

That Mr. Cooke's case in this arbitration is a simple and honest statement of facts, supported by conclusive evidence and not shaken in one single material statement; and that it acknowledges in the most liberal way the full and utmost value of every thing that Professor Wheatstone has done; and that it evinces a plain and most liberal wish, throughout, to have left the scientific department entirely in Mr. Wheatstone's hands, even in the present arbitration, if Mr. Wheatstone had only met the case with moderate fairness.

750.

Compare Mr. Cooke's Case, 2, 7—10, 68, 102, 113—116, 119—128, 190, 219, and 230, with Professor Wheatstone's four charges against Mr. Cooke, as extracted and answered, supra, 648—706.

SIXTEENTHLY.

751. That Professor Wheatstone's case, on the other
 Supra, 655—
 675, 722—
 729, et passim. hand, is from the beginning to the end of it a
 system of misrepresentations of facts, and misquotations from documents; and that all its material statements have been conclusively proved to be unfounded.

SEVENTEENTHLY.

752.

* * * * *

[See note to page 198.]

EIGHTEENTHLY.

753. That more particularly Professor Wheatstone's
 Professor
 Wheatstone's
 Case, 241—
 267. accounts, at the opening of his case, of his various
 scientific experiments, are wholly irrelevant and
 might have been omitted, and prove nothing, except that he had done nothing towards inventing the Electric Telegraph, in a period of about 15

years, during which the subject had engaged his attention, and that he was not, when Mr. Cooke consulted him and confided the practical invention to him, following up the subject with any practical views, either immediate or remote.

NINETEENTHLY.

That Professor Wheatstone's attempts to prove 754.
that he had made important or any practical ad- ^{Supra, 516—}
vances before Mr. Cooke consulted him, though in 545.
the form in which they are presented they have an
imposing appearance, are proved to be failures;
and that the statements respecting them are incon-
sistent with Professor Wheatstone's other state-
ments, and contrary to the facts; and also that ^{Evidence.}
whatever truth there is in them can be traced to ^{Letters and}
trifling circumstances of no practical consequence. ^{accounts.}

TWENTIETHLY.

That Professor Wheatstone's statements respecting 755.
the earlier interviews between the parties, though ^{Supra, 565—}
stated at considerable length, and so circumstan- 585.
tially as even to give the exact words used in con-
versation four years ago, and though conveying the
most serious insinuations against Mr. Cooke's cha- ^{Evidence.}
racter, have been conclusively proved, by docu- ^{Chiefly posted}
mentary evidence, of the existence of which Mr. ^{letters.}
Wheatstone was ignorant, to be unfounded and
untrue from beginning to end.

TWENTY-FIRSTLY.

756. That Professor Wheatstone's claim to the alarum
 Supra, 615— is an unfounded attempt to appropriate to himself a
 647. part of the invention, to which, * * *
Evidence. he has no title whatever; and that his claim is
 Instruments, clearly and conclusively disproved in every par-
 posted letters, ticular.
 Mr. Lane, Mr.
 Moore, Mr.
 Kirby, and
 Rev. T. Cooke.

TWENTY-SECONDLY.

757. That Professor Wheatstone has in his case ad-
 Supra, 648— vanced four specific charges against Mr. Cooke,
 706, and which have been clearly proved to be absolutely
 evidence there unfounded; and that the charge which is brought
 detailed. seriously and deliberately forward as the climax of
 Professor Wheatstone's complaints is not only un-
 founded, like the rest, but is also in itself frivolous
 and vexatious in the highest degree.

TWENTY-THIRDLY.

758. That Professor Wheatstone's claim to the inter-
 Supra, 655— mediate apparatus, upon which one of his charges
 676, and is based, though apparently a matter incapable of
 evidence there positive disproof, has been shown beyond dispute or
 detailed. question, by several recorded documents, and by a
 great quantity of other conclusive evidence, to have
 no foundation whatever in fact— * * *

TWENTY-FOURTHLY.

759. That Professor Wheatstone's new instruments,
 Mr. Cooke's having been carefully compared with Mr. Cooke's
 Case, 101—
 107.

original Mechanical Telegraph, clearly appear to be Drawings II.,
 only improvements on it; and that Mr. Cooke's III., VII.,
 new instruments, though also based on one of his VIII., IX. and
 own original inventions, are essentially distinct XI.
 from Professor Wheatstone's, and are the most
 valuable form of the Practical Electric Telegraph; *Evidence.*
 and especially that they are the only form capable Instruments
 of being applied conveniently to the very important and Mr. Farey.
 purposes of portable telegraphs and self-acting
 telegraphs on railways.

TWENTY-FIFTHLY.

* * * * * 760.

TWENTY-SIXTHLY.

* * * * * 761.

TWENTY-SEVENTHLY.

That, although with Mr. Cooke's perfect con- 762.
 currence and approbation Professor Wheatstone's Mr. Cooke's
 separate privileges are to be awarded to him, to the Case, 88—93.
 extent to which they were originally promised, such
 privileges were promised by Mr. Cooke in ignorance

of facts, which were purposely concealed, and that the promise of the separate privileges was obtained in a manner not creditable to Professor Wheatstone.

TWENTY-EIGHTHLY.

763.
Mr. Cooke's
Case, 195—
231.

That inasmuch as this arbitration is attributable solely to Professor Wheatstone's misconduct, he should pay the costs of the reference and award.

THE AWARD.

“As the Electric Telegraph has recently attracted a considerable share of public attention, our friends, Messrs. Cooke and Wheatstone, have been put to some inconvenience, by a misunderstanding which has prevailed respecting their relative positions in connexion with the invention. The following short statement of the facts has, therefore, at their request, been drawn up by us the undersigned Sir M. Isambard Brunel, Engineer of the Thames Tunnel, and Professor Daniell, of King’s College, as a document which either party may at pleasure make publicly known.

“In March, 1836, Mr. Cooke, while engaged at Heidelberg in scientific pursuits, witnessed, for the first time, one of those well-known experiments on electricity, considered as a possible means of communicating intelligence, which have been tried and exhibited from time to time, during many years, by various philosophers. Struck with the vast importance of an instantaneous mode of communication, to the railways then extending themselves over Great Britain, as well as to government and

THE AWARD.

general purposes, and impressed with a strong conviction that so great an object might be practically attained by means of electricity, Mr. Cooke immediately directed his attention to the adaptation of electricity to a practical system of Telegraphing; and, giving up the profession in which he was engaged, he, from that hour, devoted himself exclusively to the realization of that object. He came to England in April, 1836, to perfect his plans and instruments. In February, 1837, while engaged in completing a set of instruments for an intended experimental application of his Telegraph to a tunnel on the Liverpool and Manchester Railway, he became acquainted, through the introduction of Dr. Roget, with Professor Wheatstone, who had for several years given much attention to the subject of transmitting intelligence by electricity, and had made several discoveries of the highest importance connected with this subject. Among these were his well-known determination of the velocity of electricity, when passing through a metal wire; his experiments, in which the deflection of magnetic needles, the decomposition of water, and other voltaic and magneto-electric effects, were produced through greater lengths of wire than had ever before been experimented upon; and his original method of converting a few wires into a considerable number of circuits, so that they might transmit the greatest number of signals that can be transmitted, by a given number of wires, by the deflection of magnetic needles.

THE AWARD.

“ In May, 1837, Messrs. Cooke and Wheatstone took out a joint English patent, on a footing of equality, for their existing inventions. The terms of their partnership, which were more exactly defined and confirmed in November, 1837, by a partnership deed, vested in Mr. Cooke, as the originator of the undertaking, the exclusive management of the invention, in Great Britain, Ireland, and the Colonies, with the exclusive engineering department, as between themselves, and all the benefits arising from the laying down of the lines, and the manufacture of the instruments. As partners standing on a perfect equality, Messrs. Cooke and Wheatstone were to divide equally all proceeds arising from the granting of licenses, or from sale of the patent rights ; a per centage being first payable to Mr. Cooke, as manager. Professor Wheatstone retained an equal voice with Mr. Cooke in selecting and modifying the forms of the telegraphic instruments, and both parties pledged themselves to impart to each other, for their equal and mutual benefit, all improvements, of whatever kind, which they might become possessed of, connected with the giving of signals, or the sounding of alarums, by means of electricity. Since the formation of the partnership, the undertaking has rapidly progressed, under the constant and equally successful exertions of the parties in their distinct departments, until it has attained the character of a simple and practical system, worked out scientifically on the sure basis of actual experience.

THE AWARD.

“ Whilst Mr. Cooke is entitled to stand alone, as the gentleman to whom this country is indebted for having practically introduced and carried out the Electric Telegraph as a useful undertaking, promising to be a work of national importance; and Professor Wheatstone is acknowledged as the scientific man, whose profound and successful researches have already prepared the public to receive it as a project capable of practical application; it is to the united labours of two gentlemen so well qualified for mutual assistance, that we must attribute the rapid progress which this important invention has made during the five years since they have been associated.

M^c I^d BRUNEL.

J. F. DANIELL.

London, 27th April, 1841.”

“ London, 27th April, 1841.

“ GENTLEMEN,

We cordially acknowledge the correctness of the facts stated in the above document, and beg to express our grateful sense of the very friendly and gratifying manner in which you have recorded your opinion of our joint labours, and of the value of our invention.

We are, Gentlemen,

With feelings of the highest esteem,

Your obedient Servants,

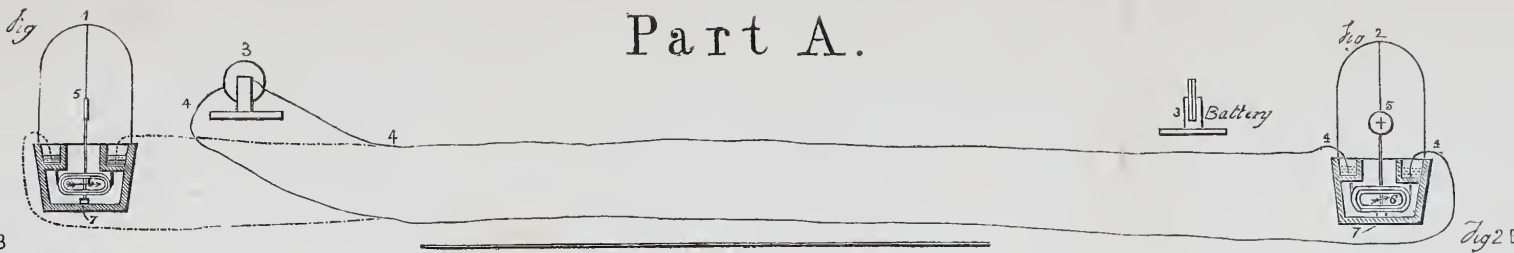
WILL^m. F. COOKE.

C. WHEATSTONE.

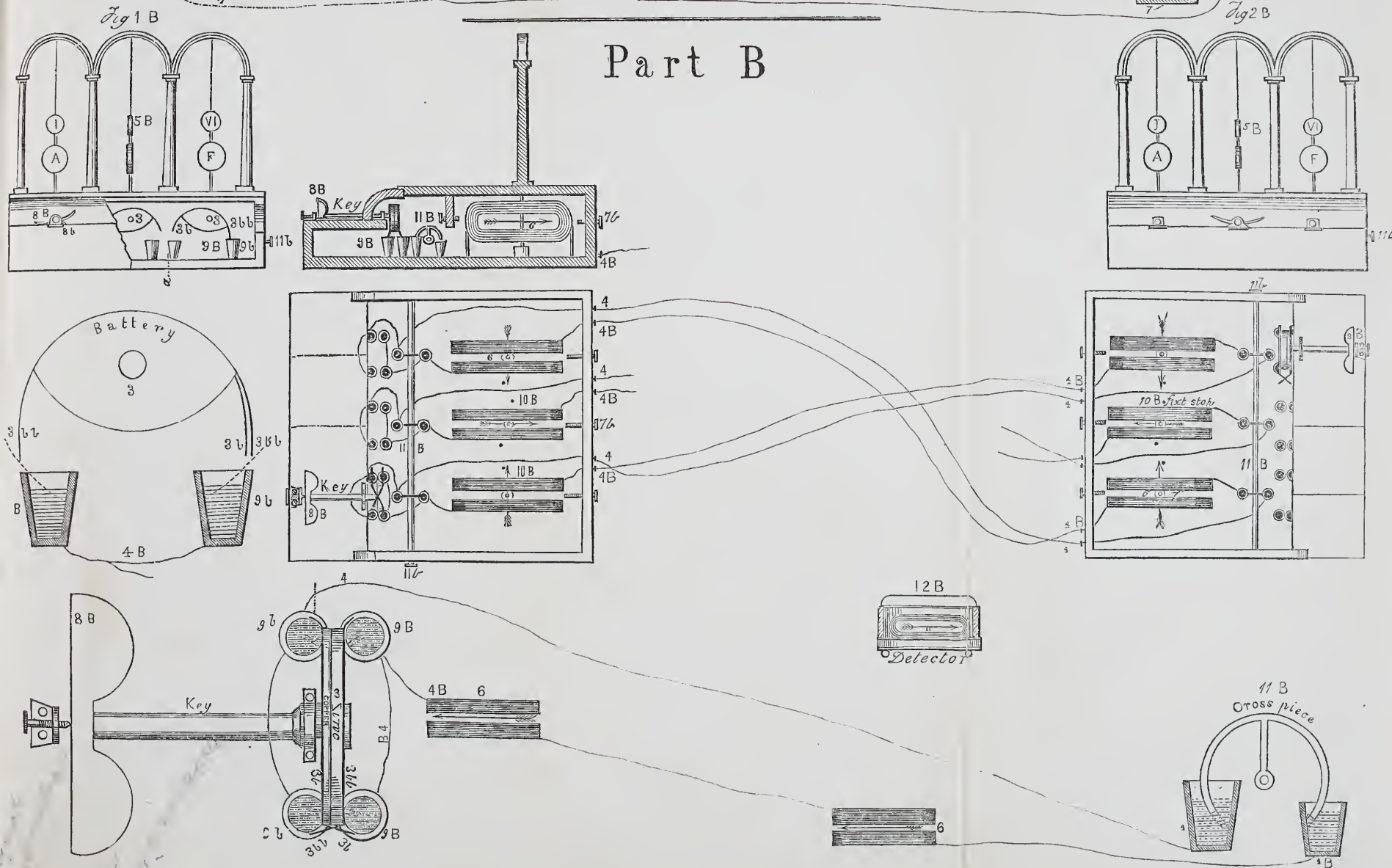
SIR M. ISAMBARD BRUNEL, and

J. F. DANIELL, Esq., Professor, &c. &c.”

Part A.



Part B

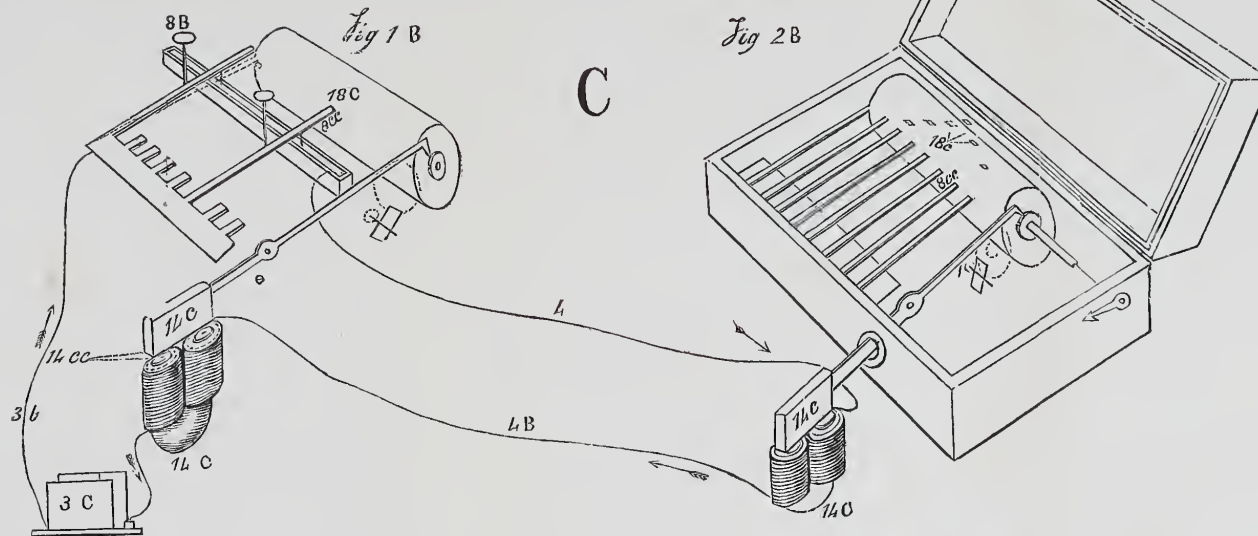


DRAWING I.
Part A.
Prof. Möncke.
Prior to March,
1836.

Part B.
Mr. Cooke.
First
Galvanometer
Telegraph,
with six wires.
March, 1836.

Detector.

ORIGIN OF Parts C and E



DRAWING II.

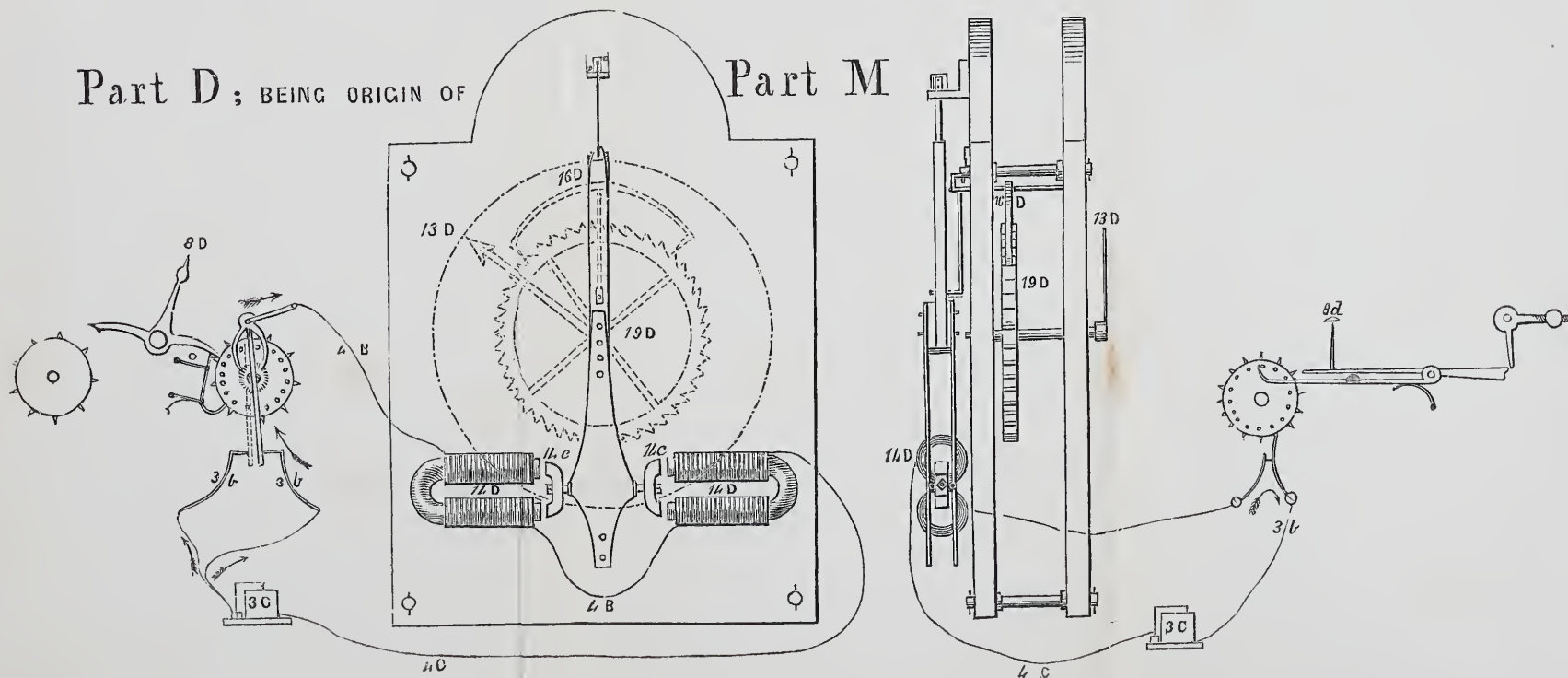
Origin of
Mechanical
Telegraph.

March, 1836.

Mr. Cooke.

Part D; BEING ORIGIN OF

Part M



Part D.

Mr. Cooke.

Origin of the
Escapement
Principle.

August, 1836.

Part C.

Part C.

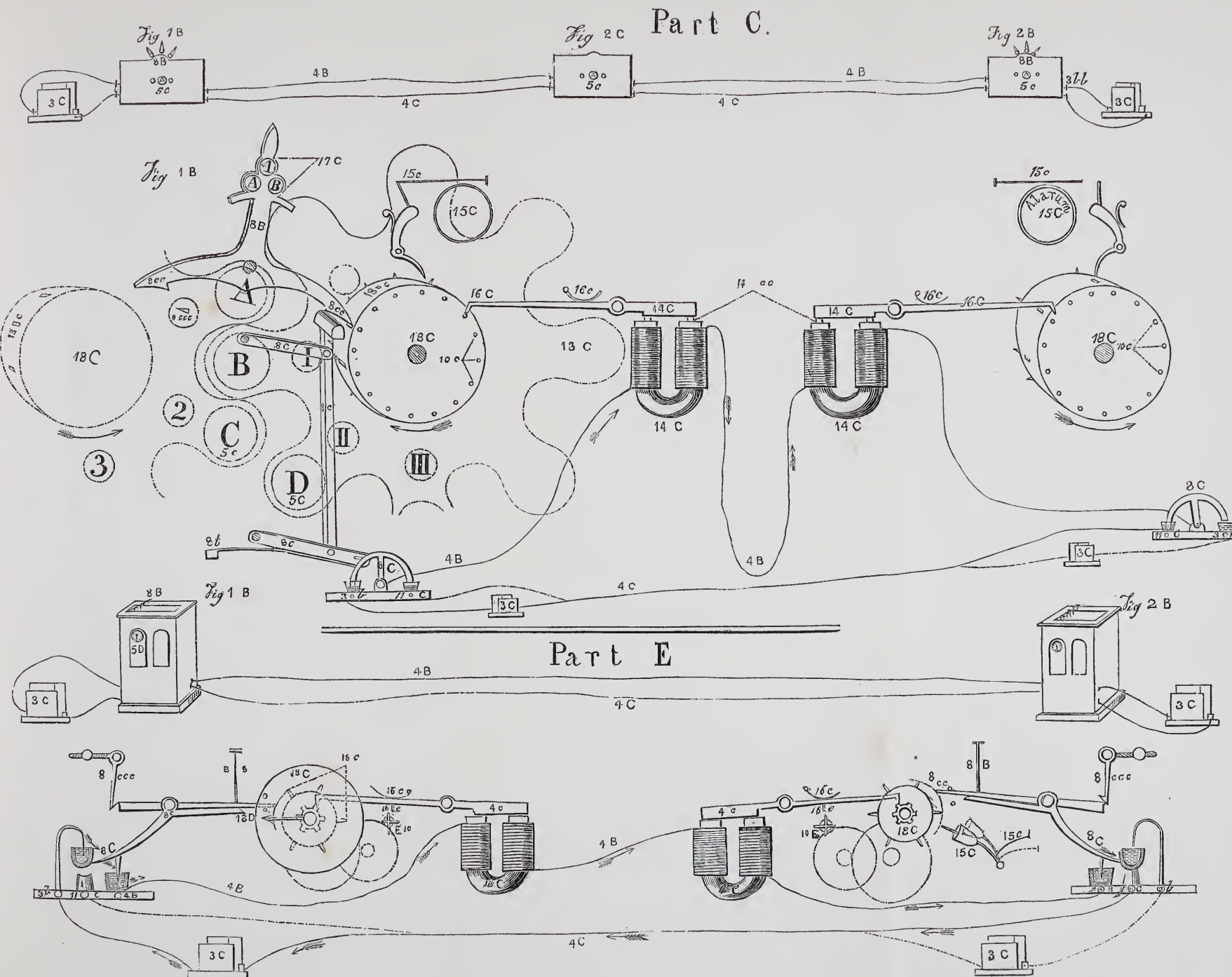
Mr. Cooke.

First
Mechanical
Telegraph.

March, 1836.

Alarum.

March, 1836.



Part E.

Mr. Cooke.

Second
Mechanical
Telegraph,
with two wires.

Feb. 1837.

Part F.
Prof.
Wheatstone's
 Permutating
 Key-board
 and only
 Instrument
 at the date of
 the Partnership.

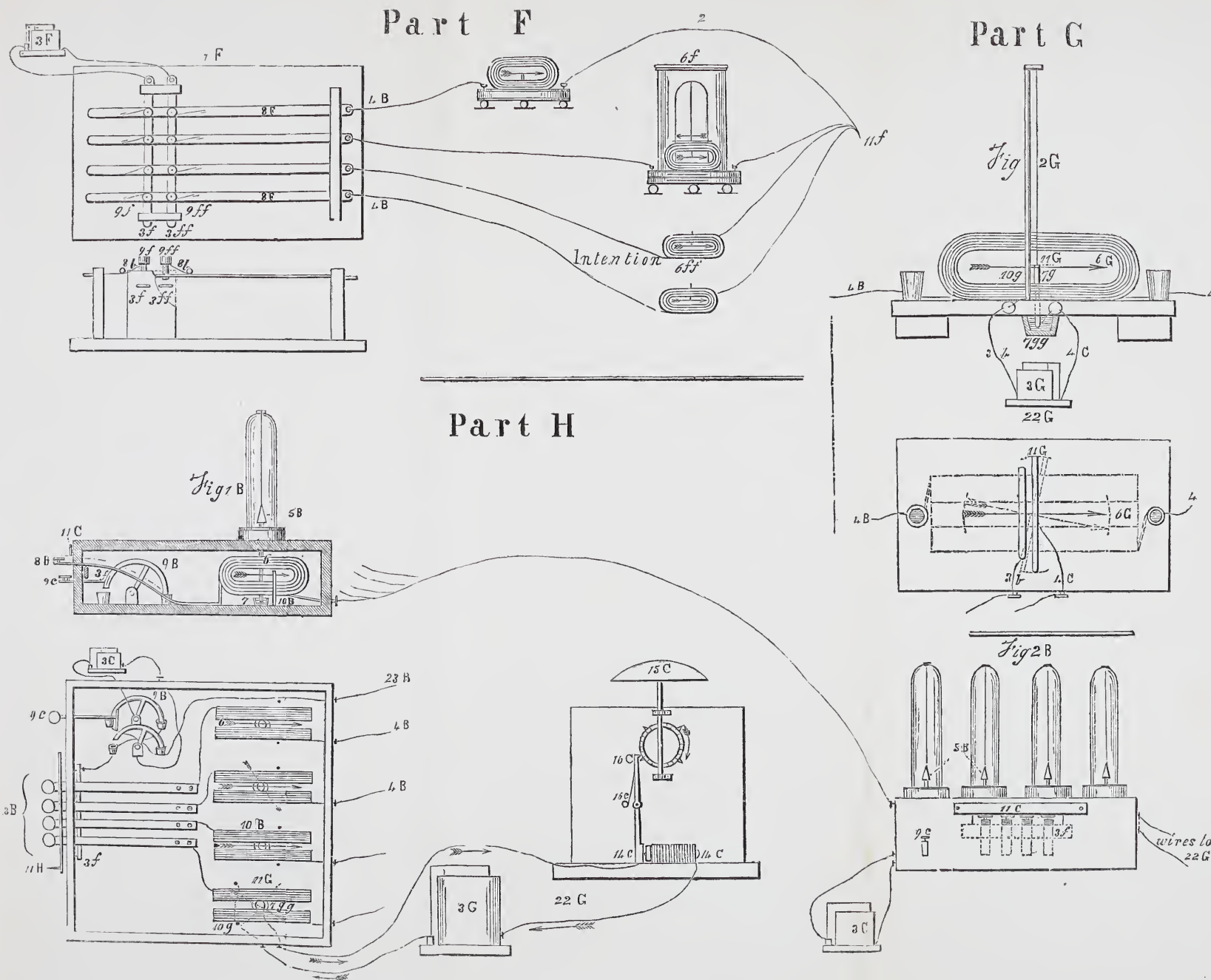
*Mr. Cooke
and Prof.
Wheatstone.*

Discharger and
Secondary
Circuit.
April, 1837.

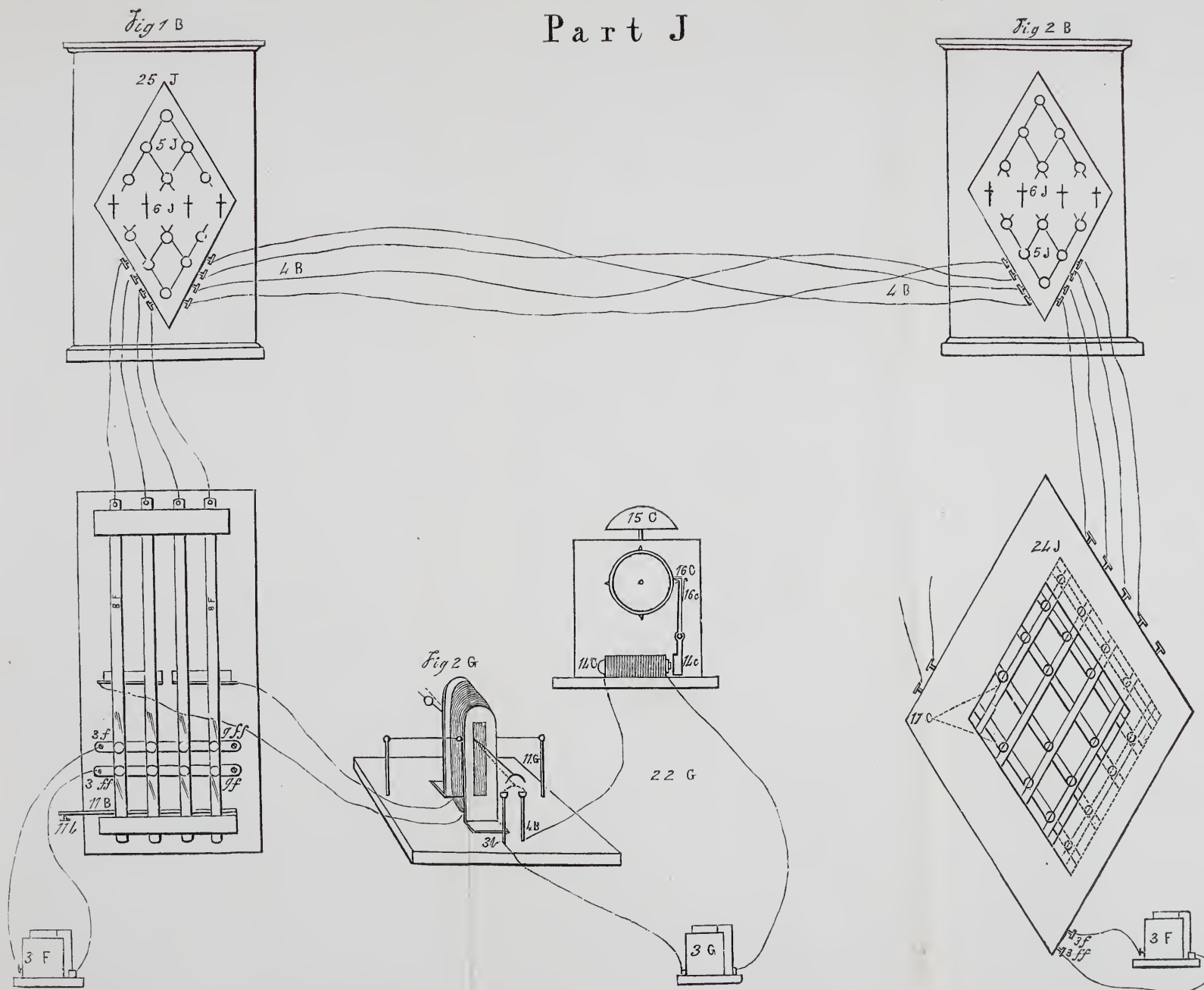
Mr. Cooke.

Second
Galvanometer
Telegraph,
(with return wire)

April, 1837,
prior to
Partnership.



Part J



Part J.

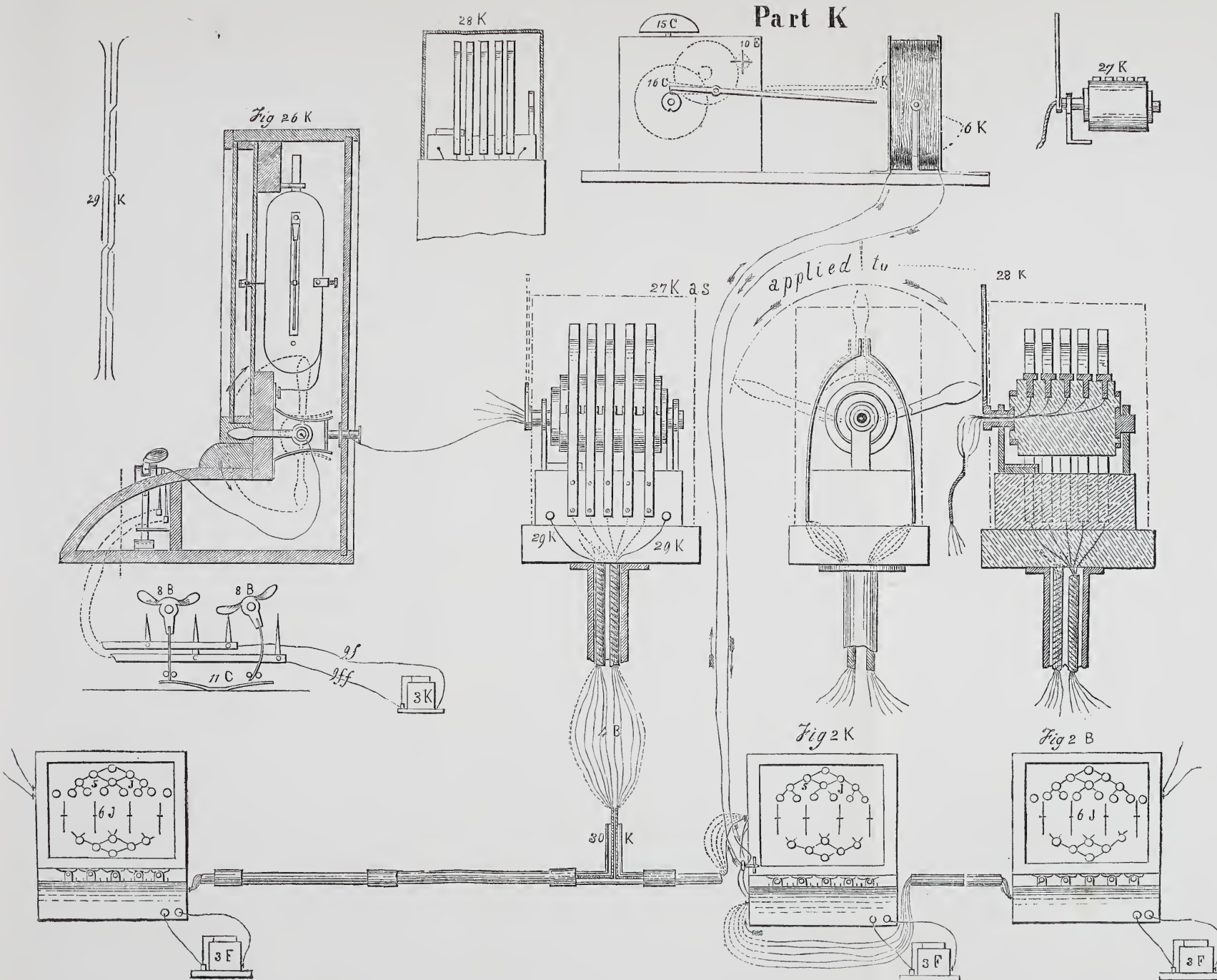
*Messrs. Cooke
and Wheatstone's
Patented
Electric
Telegraph.*

After Partnership.

First Patent.

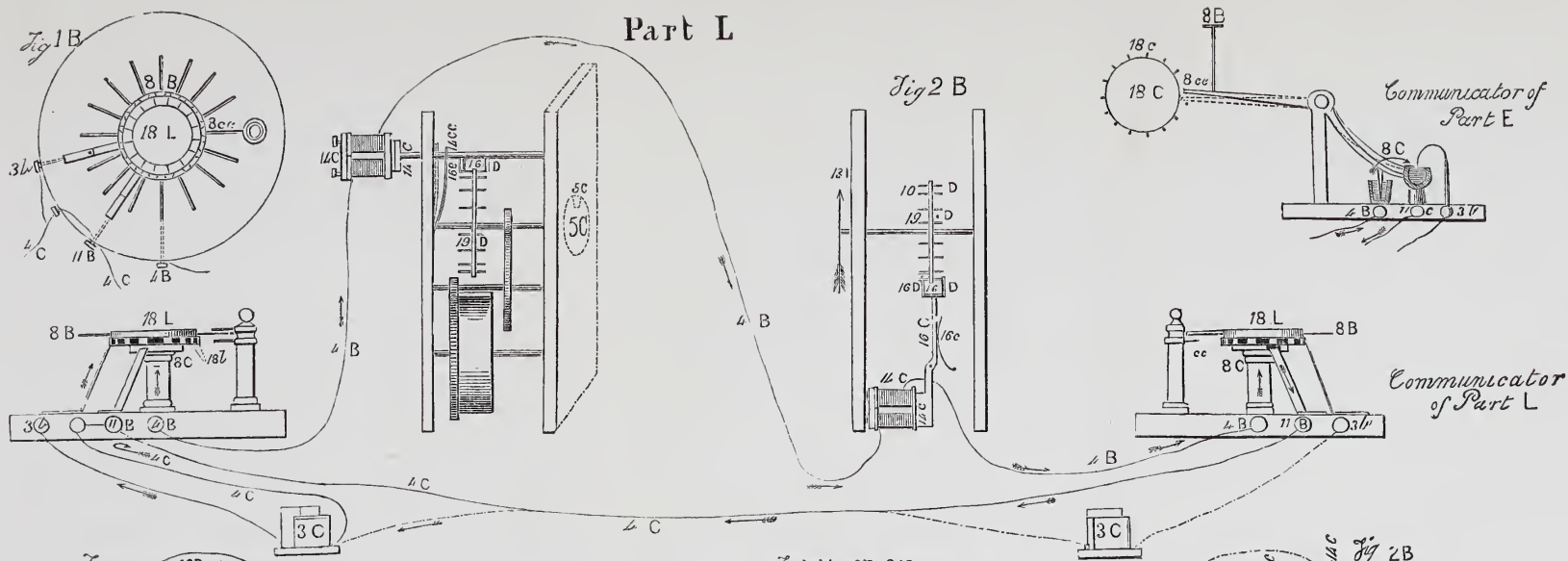
June 12, 1837.





Part K.
Mr. Cooke's
Second Patent.
April 18, 1838.
Intermediate
and Portable
Telegraphs,
and the Alarum
now in use.

Part L



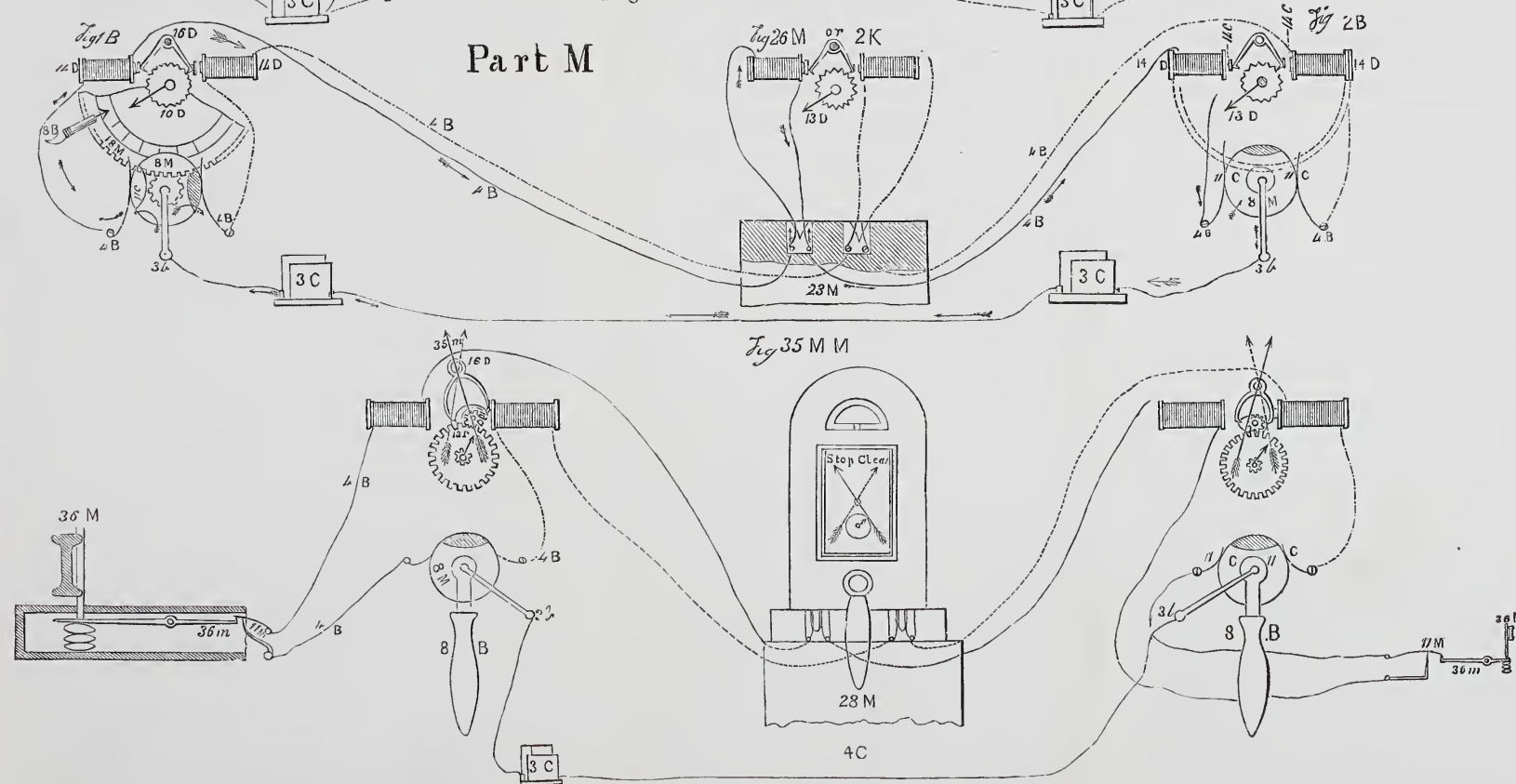
DRAWING VII.

Third Patent.
Messrs.
Wheatstone and
Cooke.

Jan. 21, 1840.

Part L.
Prof.
Wheatstone's
Escapement
Telegraph,
with two wires.

Part M



Part M.
Mr. Cooke's
Escapement
Telegraph,
with three wires.

Portable
Telegraph,
without Battery.

N.B.—The Diagrams in this Drawing are intended only to illustrate the principles on which the different instruments act, not the instruments themselves; for which, vide Drawings of the Third Specification.

DRAWING VIII.

MR. COOKE'S APPLICATION OF THE ELECTRIC TELEGRAPH TO TUNNELS, BRANCHES, CROSSINGS, &c.

FIG. 1.

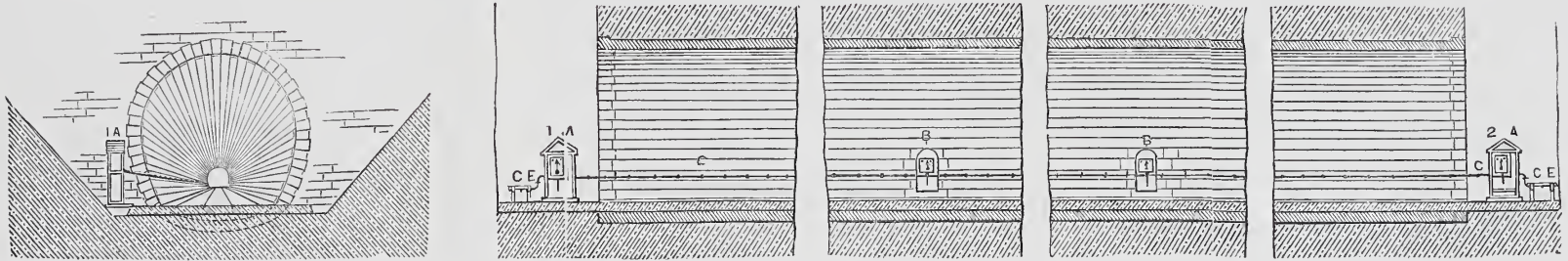


FIG. 2.

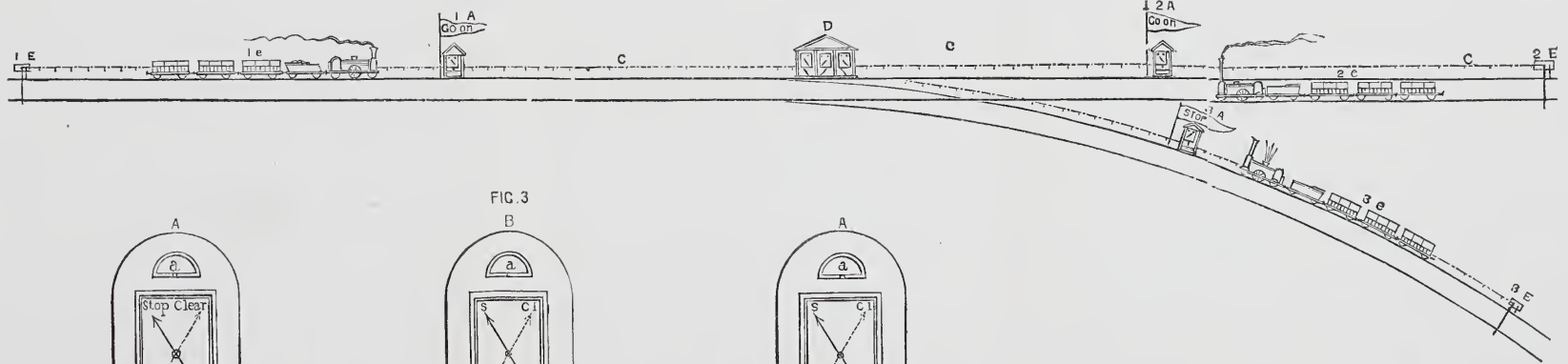
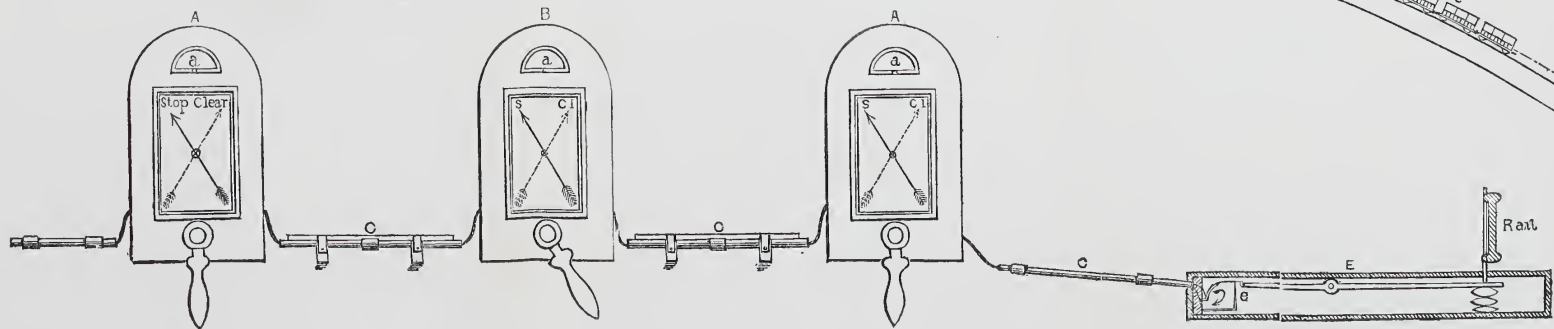
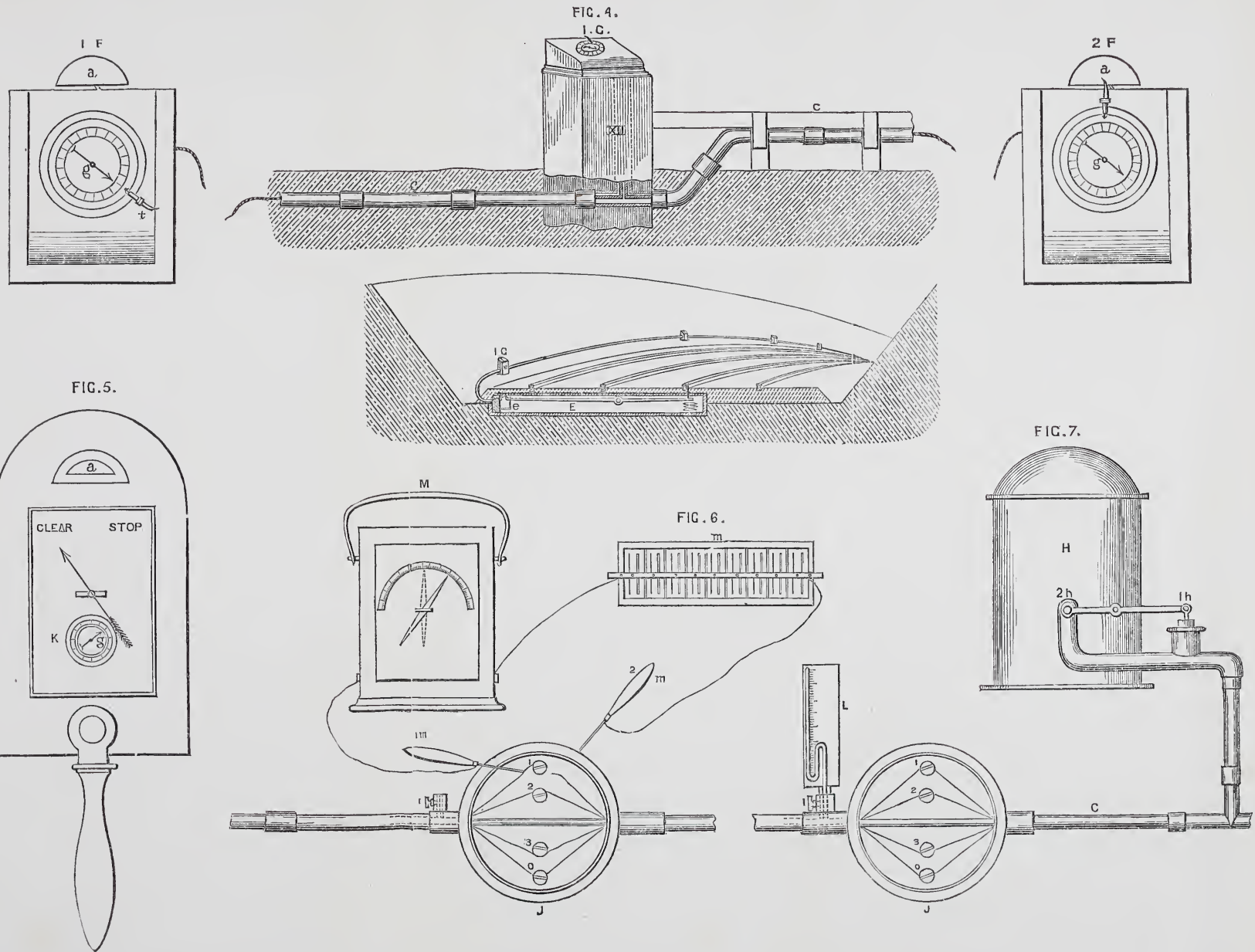


FIG. 3.



MR. COOKE'S PORTABLE TELEGRAPH FOR RAILWAYS; AIR PRESSURE APPARATUS; DETECTORS, &c.



DRAWING X.

Möncke.

Prior to March,
1836.

Cooke.

March, 1836.

Wheatstone.

Prior to
February, 1837.

Cooke.

April, 1837.

Partnership.

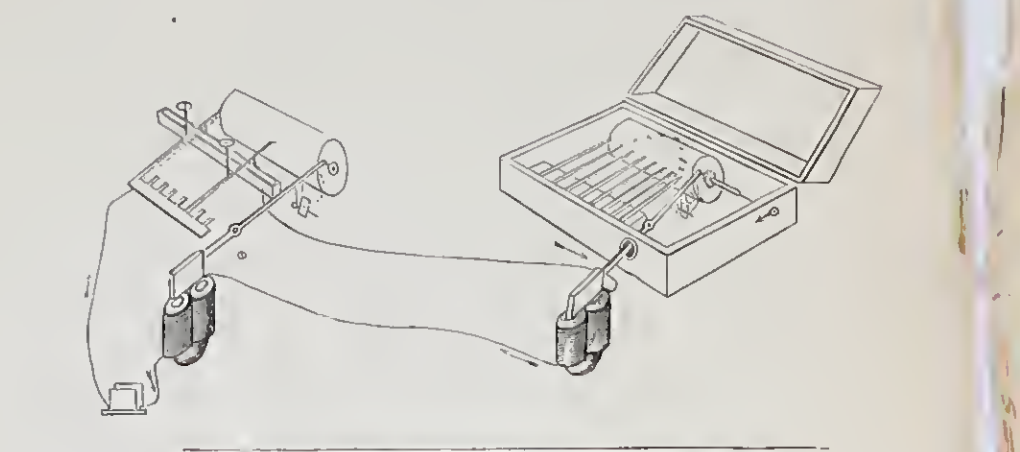
First Patent.

June 12, 1837.

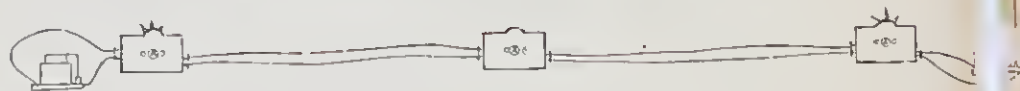
Second Patent.

April 18, 1838.

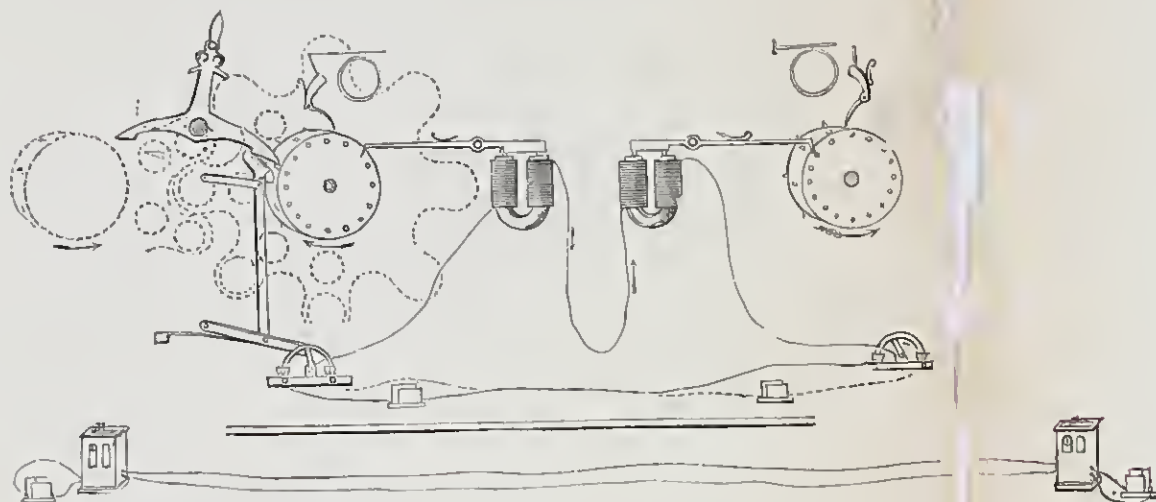
Blackwall
Telegraph.



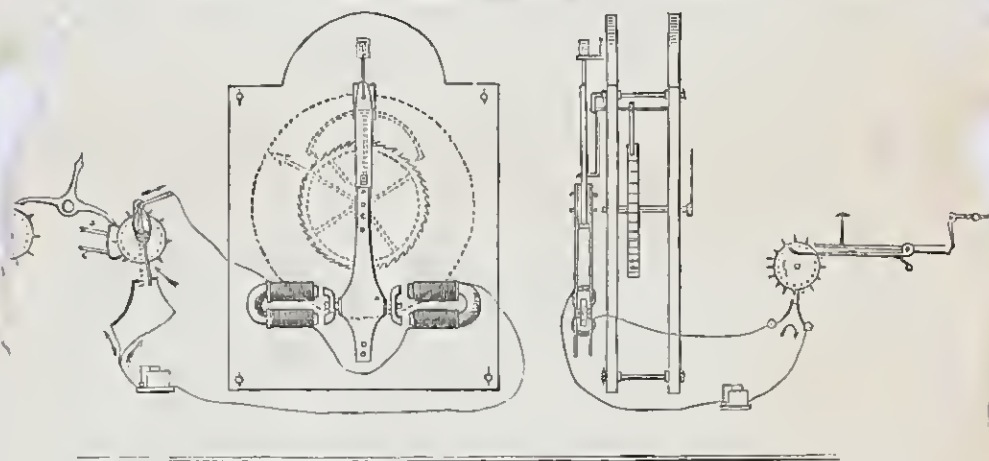
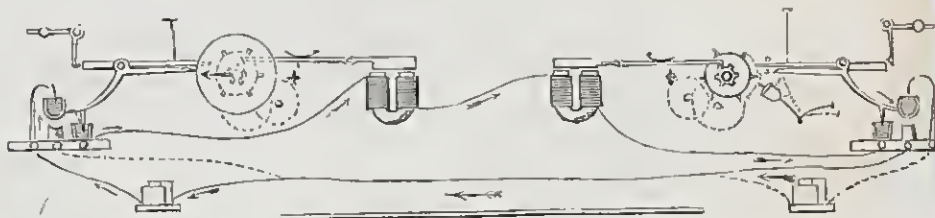
Cooke.
Original Idea
of Mechanical
Telegraph.



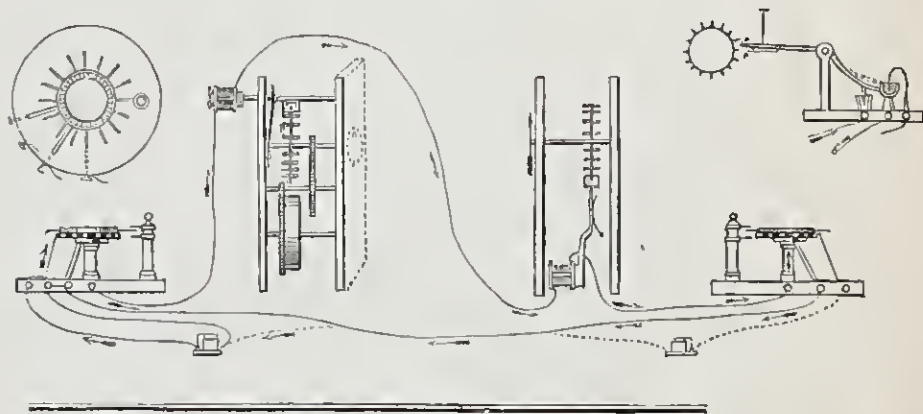
Cooke.
First Mechanical
Telegraph.
March, 1836.
Alarum.



Cooke.
Second
Mechanical
Telegraph.
February, 1837.

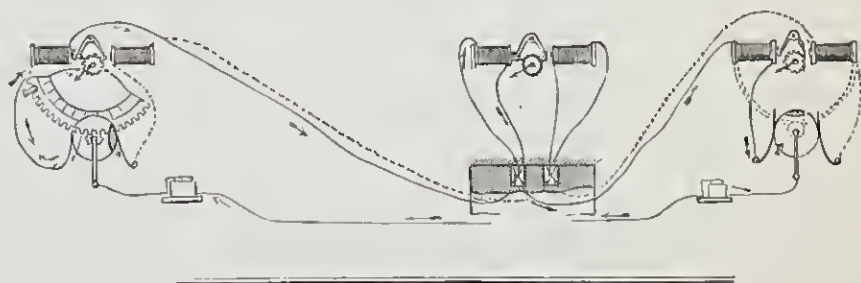


Cooke.
Experiments
on the
Escapement.
August, 1836.

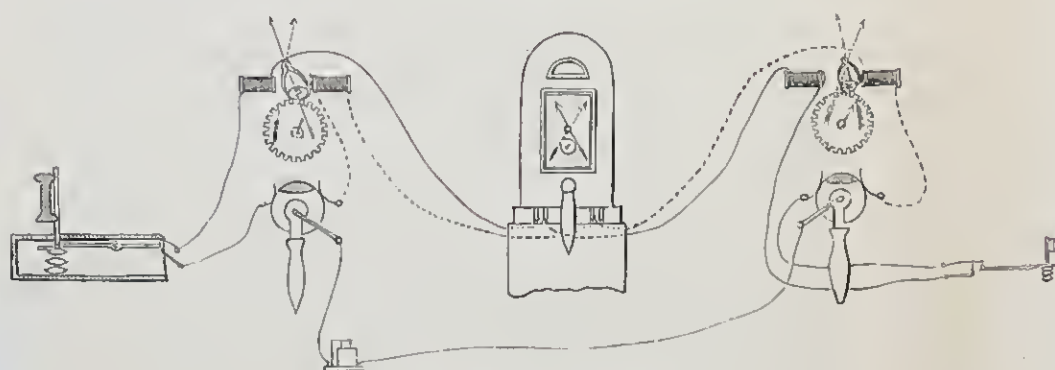


Third Patent.
Jan. 21, 1840.
Wheatstone.

Third
Mechanical
Telegraph.
Autumn of 1839.



Cooke.
Fourth
Mechanical
Telegraph.
Nov. 1839.



New
Applications.
1840.



T A B L E S.

In the Matter of the ARBITRATION between WILLIAM FOTHERGILL
COOKE and CHARLES WHEATSTONE.

GENERAL REFERENCE to the DESCRIPTIVE TABLES for MR. COOKE'S
DRAWINGS.

Date.	Descriptive Letter.	Parts where the same Inventions have again appeared.	Application of Mr. Cooke's Reciprocal Telegraphic System to various forms of Instruments :	
Mar. 1836	B	H J K	Reciprocal galvanometer communicator -	Cooke.
„	B C	E L M	- ditto - mechanical - ditto -	„
April 1838	K	L M	- ditto - intermediate, - ditto -	„
1839	B C L	- - -	- ditto - escapement - ditto -	Wheatstone.
„	B C M	- - -	- ditto - - - - ditto -	Cooke.
Description of the more important Details of the Invention :				
1. Near Telegraph :				
Mar. 1836	Fig. 1 B	passim -	Near Reciprocal Telegraph - - -	Cooke.
2. Distant Telegraph :				
	„ 2 B	„	Distant reciprocal telegraph - - -	„
	„ 2 C	- - -	- - Intermediate duplicate receiving, but not giving signals.	„
April 1838	2 K	„	- ditto - reciprocal telegraph - - -	„

Date.	Descriptive Letter.	Parts where the same Inventions have again appeared.		
Mar. 1836	3 C	E G H L M	<p>3. Battery :</p> <p>-- Battery at both termini always connected together with one of the conducting wires, and therefore requiring to make only one contact with a galvanometer wire to complete an electric circuit.</p>	Cooke.
"	4 B	passim -	<p>4. Conducting Wires :</p> <p>-- Reciprocal telegraph wire with a galvanometer or voltaic magnet, fixed permanently at each end, to give like signals simultaneously.</p>	"
"	4 C	E G H L M	<p>-- Conducting wire extending between the batteries of the distant telegraphs, sending a branch to each cross-piece. <i>Vide</i> 3 C.</p>	"
	5 B	passim -	<p>5. Signals :</p> <p>Complete set of signals for telegraphic purposes.</p>	"
"	5 C	L	<p>- ditto - ditto - marked on revolving disc, and seen through a hole, 5 c, in the fixed dial; or,</p>	"
Aug. 1836	5 D	E M	<p>-- Signals pointed out by a revolving hand on a fixed dial.</p>	"
May 1837	5 J	K	<p>-- Signals on Professor Wheatstone's converging diagram.</p>	Wheatstone.
Mar. 1837	6 G	H J	<p>6. Galvanometer and Magnetic Needles :</p> <p>Galvanometer discharger - - -</p>	{ Cooke and Wheatstone.
May 1837	6 J	K	<p>Vertical galvanometers with static needles</p>	
April 1838	6 K	passim -	<p>-- Magnetic needle for removing alarm detent by a blow.</p>	Cooke.
			<p>7. Methods of steadying Magnetic Needle:</p>	
May 1837	7 J	passim -	<p>-- By loading the needle - - -</p>	Wheatstone.
April 1838	7 K	"	<p>-- By magnetic attraction - - -</p>	Cooke.

Date.	Descriptive Letter.	Parts where the same Inventions have again appeared.		
8. Telegraph Keys:				
Mar. 1836	8 B	passim -	For Galvanometer instrument - -	Cooke.
"	8 C	"	Mechanical - ditto - -	"
Prior to } Feb. 1837 }	8 F	J K	Permutating key-board - -	Wheatstone.
9. Current Commutator:				
Mar. 1836	9 B	C E H K	For reversing the course of the electric current.	Cooke.
Prior to } Feb. 1837 }	9 F	J K	- ditto as in the permutating key-board -	Wheatstone.
10 Stops:				
Mar. 1836	10 B	G H J K	-- Stops in the galvanometer telegraph to determine the extent of angular motion of needles.	Cooke.
"	10 C	{ D E H J } { K L M }	-- Stops in mechanical telegraph to arrest mechanism.	"
11. Cross-Piece:				
"	11 B	G H J L	-- Occasional cross-piece or bridge by which the metallic circuit is restored for a reply after giving signals, and must be set after each correspondence, or the communication will be cut off.	"
"	11 C	E J K M	-- Self-acting cross-piece setting itself after each signal.	"
1840	11 M	- - -	-- ditto - for engine-warner - -	"
12. Detector:				
1836	12 B	passim -	-- For discovering injuries to wires from fracture, water or contact.	"
13. Revolving Dial or Hand:				
1836	13 C	L	-- Revolving dial, capable of being arrested at any part of its revolution, for giving signals in mechanical telegraph.	"
"	13 D	E M	Revolving hand - ditto - ditto. -	"
14. Voltaic Magnets.				
March -	14 C	D E L M	-- For giving signals by acting on the detent of mechanism.	"
"	14 C	{ D E H J } { K L M }	For sounding alarums - ditto - ditto	"

Date.	Descriptive Letter.	Parts where the same Inventions have again appeared.		
			15. Alarum :	
„	15 C	passim -	-- Sounded by maintaining power on removal of detent.	Cooke.
			16. Re-acting Detent :	
Mar. 1836	16 C	E H J K	For stopping mechanical telegraph or alarum, &c.	„
Aug. 1836	16 D	L M	Escapement detent.	
			17. Signals on the Keys :	
Mar. 1836	17 C	{ E H J K } { L M }	-- Each key marked with the signal it is adapted to give.	„
			18. Revolving Communicator :	
„	18 C	E	-- Cylinder of first and second mechanical telegraph, with pins, 18 c, for dividing its mechanical motion.	„
1839	18 L	- - -	Capstan, with plates, for dividing dial -	Wheatstone.
1840	18 M	- - -	-- Concentric with multiplying wheel for directing the course of a constant current.	Cooke.
			19. Escapement :	
Aug. 1836	19 D	L M	- - As applied to divide clock-work motion of mechanical telegraph.	„
			20. Permutating Key-Board :	
Prior to } Feb. 1837 }	20 F	J K	- - - - -	Wheatstone.
			21. Constant Current :	
„	21 J	- - -	-- Occasionally diverted from one channel to another ; an idea claimed by Professor Wheatstone, but never applied.	„
1839	21 M	- - -	-- Applied by Mr. Cooke to his escapement telegraph.	Cooke.
			22. Discharger :	
Mar. 1837	22 G	H J	By which a second electric circuit is completed.	{ Cooke and Wheatstone.
			23. Blank or Return Wire :	
April 1837	23 H	J K M	-- Used to complete metallic circuits with the reciprocal telegraph wires to give single signals.	Cooke.

Date.	Descriptive Letter.	Parts where the same Inventions have again appeared.		
1837	24 J	K L M	24. Symmetrical Key Frame : -- Corresponding in form with the dial of the telegraph, and having the keys lettered.	Cooke.
May 1837	25 J	K	25. Vertical Diagram : -- Giving signals by the mutual convergence of magnetic needles.	Wheatstone.
April 1838	26 K	M	26. Portable Telegraph : -- Conveyed by each train for application on the road when needed.	Cooke.
"	27 K	M	27. Current Director : -- For giving the proper direction to the electric current in an intermediate or portable telegraph.	"
"	28 K	M	28. Mile-post Arrangement. -- For the application of the portable telegraph.	"
"	29 K	passim -	29. Spare Wires : -- For replacing injured telegraph wires without disturbing the general line.	"
"		passim -	30. Iron Tubing and Fittings : For protecting wires - - - -	"
	31 K	L	31. Alarum : -- Sounded by the blow of a heavy magnetic needle, releasing the detent, superseding the discharger : arrangement now in use.	"
Jan. 1840	31 L	L	-- 31 L, an alarum, sounded by a magnetic needle, interposing itself between the blow of a hammer and the detent.	Wheatstone.
"	32 L	- - -	32. Electro-magnetic Machine : -- Proposed to be employed instead of a voltaic battery.	"
"	33 L	- - -	33. First Escapement Telegraph : As described in the third patent -	"

Date.	Descriptive Letter.	Parts where the same Inventions have again appeared.		
Jan. 1840	34 M	- - -	34. Second Escapement Telegraph: As described in the third patent - -	Cooke.
1840	35 M	- - -	35. Self-acting Telegraph: As applicable to tunnels, level crossings, &c.	„
	36 M	- - -	36. Engine Warner: Brought into action by a passing train -	„
	37 M	- - -	37. Air Pressure Apparatus: -- For excluding water from the protecting tubes, and drying out damp.	„
	38 M	- - -	38. Barometrical Detector: -- For testing the soundness of the tubes, and discovering injuries done to them.	„

In the Matter of the ARBITRATION between WILLIAM FOTHERGILL
COOKE and CHARLES WHEATSTONE.

TABLES TO MR. COOKE'S DRAWINGS.

PART A.—DRAWING 1.

As before.	Improved.	New.	
			Professor Möneke's Apparatus, prior to 6 March 1836.
			One Pair of Instruments made.
Fig. 1			Principle,—Giving two signals at a distance by galvanometers.
2			Near single galvanometer.
3			Distant - - ditto
4			Battery.
5			Conducting wires.
6			Signal.
7			Galvanometer, with magnetic needle, -- Steadying piece : dipping in a steadying cup of mercury to support the needle and check oscillation.

PART B.—DRAWING 1.

		Mr. Cooke, 9th to 15th March 1836.
		First Galvanometer Telegraph with 6 wires.
		One Pair made.
		Principle,—Telegraph with 26 signals acting simultaneously at both termini, worked by keys, with cross-piece for reply ; forming "The Reciprocal Telegraph System."

PART B.—DRAWING 1—*continued.*

As before.	Improved.	New.	
		B	-- "Reciprocal galvanometer communicator," giving signals by magnetic needles. Including 3 b, 3 b b, battery pole-bars; 8 B keys; 9 B 9 b, current-commutator; and 11 B occasional cross-piece.
	Fig. 1 B	- - -	Near reciprocal telegraph.
	Fig. 2 B	- - -	Distant - ditto
3	3 b, 3 b b	- - -	-- 3 b, 3 b b commutating battery pole-bars for connecting battery with conducting wires, on pressure of keys. 3 b, copper; 3 b b, zinc.
4	4 B	- - -	-- 4 B, Galvanometer telegraph wire with a reciprocal galvanometer fixed permanently at each end; or, "Reciprocal Telegraph wire."
	5 B	- - -	Complete set of 26 simple and compound signals.
6, 7	7 b	- - -	7 b, iron screws for steadying the needles.
		8 B, 8 b	-- 8 B, "communicator keys" for uniting the ends of the conducting wires with the poles of the battery, so as to make the current pass in either direction through the conducting wires.
			-- 8 b, reacting spring; restoring the key to its place.
		9 B, 9 b	-- current commutator, for reversing the direction of the electric current. 9 B, zinc; 9 b, copper.
		10 B	Fixed stops for limiting the motion of the needle.
		11 B, 11 b	-- 11 B, occasional or moveable cross-piece; 11 b, handle of ditto.
		12 B	-- Detector for discovering injury done to the conducting wires, by water, fracture or contact.

PART C.—DRAWING 3.

As before.	Improved.	New.	Mr. Cooke, 17 March 1836.
			First Mechanical Telegraph (origin-musical box C, <i>vide</i> Drawing 2.) One Instrument made.
			Principle,—Reciprocal telegraph with “intermediate duplicates” worked by maintaining power of mechanism on a detent being removed by the occasional attractive force of a voltaic magnet, the signals being given by a revolving dial stopped at any part of its revolution by a reacting spring or balance weight, when the signal to be given is presented on the dial opposite to a hole in a fixed plate.
	B C	- - -	-- “Reciprocal mechanical communicator” for giving signals by division of mechanical motion, including as before, 3 b, pole-bars; 8 B, reacting keys; 9 c, current commutator, and 11 C, self-acting cross-piece. Also these additional parts, 18 C, revolving cylinder; 18 c, signal-pins.
Fig. 1 B Fig. 2 B	Fig. 2 C	- - -	Fig. 2 C, duplicates at intermediate places.
3, 3 b, 3 b b	3 C	- - -	-- 3 C, batteries permanently connected with both ends of the conducting wire 4 C.
4 B	4 C	- - -	-- 4 C, battery-conducting-wire in permanent connexion with cross-piece 11 C and battery 3 C at each terminus, ready to allow the current to pass through the near cross-piece from the distant battery when receiving a signal; or to transmit the current from the near battery through the distant cross-piece when giving a signal.
	5 C, 5 c	- - -	-- 5 C, revolving signals, comprising two circles of signals, the outer being letters A, B, C, &c., and the inner, figures I. II. &c., 1, 2, &c.; 5 c, hole in front frame through which signals appear.
8 B 8 b	8 C 8 c 8 c c 8 c c c	- - -	-- 8 c, a parallel movement or prolongation common to all the keys 8 B, and forming in 8 C a moveable termination of the “reciprocal telegraph wire,” 4 B; which termination is by the action of any one of the keys disconnected from the cross-piece 11 C and connected with one pole of the battery 3 b, the reacting spring 8 b restoring after each signal the former connexion, and also replacing the keys.

PART C.—DRAWING 3.—*continued.*

As before.	Improved.	New.	
			<p>-- 8 c c, stop of the key 8 B, determining the portion of a revolution to be made by the revolving communicator for giving the signal, corresponding with each particular key.</p> <p>-- 8 c c c, a catch to detain the key 8 B upon being pressed down, till struck up by the signal-pin 18 c pressing against its stop 8 c c.</p>
9 B	9 c	- - -	<p>-- 9 c, current commutator worked by a key (not shown in the drawings); its office being to reverse the current, by which a shutter is moved which conceals the letters when figures are represented, and <i>vice versâ</i>.</p>
	10 c	- - -	<p>-- Stops corresponding with signals, and by which the detent 16 C arrests the mechanism, when the signal to be given is presented by the dial at the hole 5 c.</p>
	11 C	- - -	<p>-- Self-acting cross-piece only requiring to make one connexion to restore the metallic circuit, being in permanent connexion with battery telegraph wire 4 C.</p>
12 B	- - -	13 C	13 C, revolving dial for carrying signals.
		14 C 14 c, 14 c c }	<p>-- 14 C, voltaic magnet for withdrawing detents occasionally from mechanism. 14 c, armature or keeper. 14 c c, brass pins to prevent retentive contact. <i>N.B.</i>—Two magnets are used in this instrument, though only one is represented in the drawings.</p>
		15 C, 15 c	<p>-- 15 C, clock-work alarum, sounded on the removal of a detent by magnetic attraction; 15 c, pin for preventing its action by pushing the hammer aside when the alarum is not wanted.</p>
		16 C, 16 c	<p>-- Reacting detent withdrawn from the mechanism by the occasional attraction of the voltaic magnet 14 C, and by its own reaction stopping the mechanism when the signal to be given is presented at the hole 5 c, on the attraction being made to cease by breaking the current. 16 c, reacting spring or balance-weight of detent.</p>
		17 C	Each signal marked on the key adapted for giving it.

PART C.—DRAWING 3.—*continued.*

As before.	Improved.	New.	
		18 C, 18 c	<p>-- 18 C, revolving cylinder, or communicator concentric with the signals, carrying a pin for each key and signal.</p> <p>18 c, signal-pins dividing the revolving communicator into equal parts, and breaking the current chronometrically, each pin corresponding with its appropriate key, and with the signal on the dial to be given by that key at the hole 5 c.</p>

PART D.—DRAWING 2.

			Mr. Cooke, July 1836.
			Experimental Escapement Instrument, two Wires and Two Magnets.
			One made.
			Principle,—Vibrating pendulum alternately retained by one of two magnets (on the same conducting wire), actuated by escape-wheel; the signals being given by an index-hand.
B C 3 C 4 B, 4 C	5 D	- - -	-- 5 D, signals (not represented) on a fixed dial pointed out by a revolving hand, 13 D.
	8 D, 8 d	- - -	-- Two forms of communicator actuated by maintaining power, and adapted for making and breaking the current alternately, so as to correspond with alternate action of the signal-giving escapement, 16 D.
	10 D	- - -	-- Teeth of scape-wheel by which detent arrests mechanism.
	13 D, 13 d	- - -	-- 13 D, revolving hand pointing out signals on 13 d, fixed dial (not represented).
14 c	14 D } 14 D }	- - -	-- 14 D, 14 D, two magnets for alternately detaining detent.
	16 D	- - -	-- Alternating detent in the form of an anchor escapement, stopping clockwork by catching the teeth (10 D) of scape-wheel (19 D.)
17 C	- - -	19 D	-- Scape-wheel carrying the revolving hand 13 D on its arbor.

PART E.—DRAWING 3.

As before.	Improved.	New.	Mr. Cooke, 10 February 1837.
			Second mechanical instrument; two wires; four instruments made; principle same as part C.
B, C			
Fig. 1 B			
2 B			
3 C			
4 B, 4 C			
5 C, 5 D			
8 B, 8 C			
9 C	- - -	- - -	(not shown in the drawing.)
10 C	10 E	- - -	10 E, fan-wheel by which detent arrests mechanism.
11 C			
12 B			
13 C, 13 D			
14 C, 14 c			
15 C, 15 c			
16 C, 16 c	16 c	- - -	16 c, detent catching fan-wheel.
17 C			
18 C, 18 c			

PART F.—DRAWING 4.

			Professor Wheatstone.
			Prior to March 1837.
			Two Key-boards made, four Wires, four Galvanometers (intended.)
			Principle,—To give a complete set of signals at a distance (intention) by the motion of two or more horizontal magnetic needles, with permutating keys, and commutating pole-bars; giving the maximum number of signals by the minimum number of wires required for the galvanometer telegraph; but not qualified to act reciprocally.
	1 F	- - -	Near key-board.
2	- " -	- - -	Distant signal galvanometers (intention.)
	3 F	- - -	One battery to several circuits.
	3 f, 3 f f	- - -	3 f, 3 f f, fixed pole-bars.

PART F.—DRAWING 4.—*continued.*

As before.	Improved.	New.	
4 B	6 f, 6 f f	- - -	-- 6 f, two galvanometers used with the key-board (1 F) ; 6 f f, two others (intention.)
8 b	8 F 9 f, 9 f f	- - -	-- 8 F, set of permutating keys, each with 9 f, 9 f f, two commutating buttons, for causing the current to pass in either direction along any of the four conducting wires, at least two keys being moved to give each signal.
11 f	- - -	- - -	-- Distant ends of wires twisted and untwisted instead of cross-piece.
		20 F	-- Principle of permutating a set of wires with a key-board and signal apparatus (intended) to correspond.
		21 F	-- Principle of a constant circuit never applied by Professor Wheatstone, but afterwards claimed by him in Mr. Cooke's three-wire telegraph, included in the third English patent.
			<i>N.B.</i> —This part F, includes all Professor Wheatstone's inventions connected with the patented telegraph, at the period of Mr. Cooke's inviting him to lend his scientific aid to the invention, and join Mr. Cooke in the patent the latter was about to take out.

PART G.—DRAWING 4.

	Mr. Cooke and Professor Wheatstone, April 1837.
	Secondary circuit and discharger applied to Mr. Cooke's original alarum (now superseded in practice by Mr. Cooke's alarum, described in the second English specification.)
	Principle,—The motion imparted to a galvanometer needle by a distant battery being made to complete the circuit of a second battery, which second battery excited temporary magnetism in a voltaic magnet, and by its attraction removed the detent of clock-work mechanism.

PART G.—DRAWING 4.—*continued.*

As before.	Improved.	New.	
		G	-- Secondary circuit, completed at the distant telegraph by a discharger in the primary circuit excited by the battery of the near telegraph.
	Fig. 2 G.	- - -	-- Part of the distant galvanometer instrument forming discharger.
	3 G	- - -	Secondary battery.
3 b, 4 C	- - -	- - -	-- 3 b, battery-wire terminating in the stop 10 g, and 4 C in the cross-piece 11 G, so that when the magnetic needle was moved by an electric current, the cross-piece 11 G was brought into connexion with stop 10 g, and completed the circuit of the secondary battery 3 G.
4, 4 B	6 G	- - -	Galvanometer needle carrying the cross-piece 11 G.
	7 g, 7 g g	- - -	-- 7 g, Connecting and steadying platinum-piece immersed in 7 g g, a mercury cup.
	10 g	- - -	-- Fixed stop, being the termination of battery-wire, 3 b.
	11 G	- - -	-- 11 G, the moveable cross-piece here fixed on axis of magnetic needle.
		22 G	Discharger and secondary circuit.

PART H.—DRAWING 4.

Mr. Cooke, April, 1837.

Second Galvanometer Telegraph.

One Pair made.

Principle,—Commutation of several galvanometer wires with one blank or return wire. Signals given by the motion of one or more needles, as in part B.

B
Fig. 1 B
Fig. 2 B
Fig. 2 G
3 C, 3 F
3 G

PART H.—DRAWING 4.—continued.

As before.	Improved.	New.	
4 B, 4 C 5 B 6, 7 8 B, 8 b 9 B, 9 c 10 B	- - - 11 H	- - - - - -	4 C. <i>Vide</i> 23 H (<i>infra</i> .) - - Moveable cross-piece, being the termination of the return wire 23 G.
12 B 14 C, 14 c 15 C 16 C, 16 c 17 C 22 G		23 H	. - Blank or return wire common to more than one reciprocal galvanometer wire otherwise similar, in its connexions with the batteries and cross-pieces at both terminal instruments, to the battery-wire 4 C.

PART J.—DRAWING 5.

			Messrs. Cooke and Wheatstone's patented Electric Telegraph, June 12, 1837.
			Combining with Mr. Cooke's Reciprocal Telegraphic System and Alarum Professor Wheatstone's Permutating Key-board and Vertical Dial; the Vertical Dial having been invented after the partnership was formed, and Professor Wheatstone had become acquainted with Mr. Cooke's Reciprocal Telegraphic System.
			Vertical Dial Telegraph.
			Principle,—The same as F applied to the "reciprocal system" with the improvements of vertical galvanometers and astatic needles, and the invention of the converging vertical diagram.
B Fig. 1 B } Fig. 2 B } Fig. 2 G 3 F, 3 f, 3 ff 3 G	- - -	- - -	{ Figs. 1 B, 2 B. Near and distant telegraph, the keys being distinct from the signal apparatus.

PART J.—DRAWING 5.—*continued.*

As before.	Improved.	New.	
4 B	5 J	- - -	-- 5 J. Complete set of signals given by the mutual convergence of two or more vertical needles pointing to a letter on the vertical dial.
6 G	6 J	- - -	Vertical galvanometers with astatic needles.
	7 J	- - -	-- Needles steadied after each signal by their lower ends being loaded.
8 F 9 f, 9 f f 10 B 11 B, 11 b 11 C	- - -	- - -	-- 11 C. Self-acting cross-piece first applied to galvanometer key-board in 24 J (not represented in the drawing).
12 B 14 C, 14 c 15 C 16 C 17 C 20 F 22 G	- - -	- - -	17 C applied to 24 J.
	24 J	- - -	-- 24 J. Professor Wheatstone's Key-board corresponding with diagram, being an improvement on one invented and used by Mr. Cooke on the London and Birmingham Railway some weeks before.
			<i>N.B.</i> —This key-board was made for a 5-needle instrument, though represented with the original 4-needle model-instrument in the drawing.
		25 J	-- Vertical diagram, with vertical galvanometers and astatic needles.
			For further description, <i>vide</i> First English Specification,

PART K.—DRAWING 6.

Old.	Improved.	New.	Mr. Cooke.
			Second English Patent, sealed 18th April 1838.
		K	- - Power of communicating from intermediate points in either direction.
			Principles,—
			1. Intermediate telegraph, capable of working as a terminal telegraph with 1 B or 2 B.
			II. Portable telegraph, capable of being applied at convenient points any where along a line of telegraph for corresponding in cases of emergency with fig. 1 B, fig. 2 B, or fig. 2 C.
			III. Alarum, discharged by the blow of a magnetic needle on the detent.
B Fig. 1 B Fig. 2 B Fig. 2 C	Fig. 2 K	- - -	- - Fig. 2 K. "Intermediate reciprocal telegraph," with the power of working both ways as a terminal telegraph; but when not working, the alarum belonging to it can be sounded from either terminus to demand attention; but when working with 1 B, the alarum is set on the side of 2 B, and <i>vice versa</i> .
3 F	3 K	- - -	- - 3 K. Battery to portable or intermediate telegraph.
4 B 5 J, 6 J	6 K	- - -	Magnetic needle for removing alarum detent.
7 J	7 K	- - -	- - 7 K. Adjusting and steadying magnet, employed for the first time with vertical needles.
8 B, 8 F 9 f, 9 ff 10 E 11 C 12 B 15 C 16 C 17 C 20 F 23 H	24 K	- - -	24 K. Key-board, corresponding with diagram.
25 J		Fig. 26 K	"Portable telegraph."

PART K.—DRAWING 6.—*continued.*

Old.	Improved.	New.	
		27 K	- - "Current director," to direct the currents and the communications either to fig. 1 B or fig. 2 B, as required.
		28 K	- - Mile-post arrangements for the connexion of portable telegraph, and for proving the wires.
		29 K	- - Spare wires, by means of which faulty wires may be restored at several places without disturbing the general line.
		30 K	- - Iron tubing and fittings for the protection of the conducting wires and admitting of their being carried under-ground.
		Fig. 31 K	- - Galvanometer needle, removing detent of alarum by a blow, as used on the Great Western Railway and Blackwall Railway, superseding for the first time the secondary circuit.
			For further description of drawings, see Second Specification.

PART L.—DRAWING 7.

		Professor Wheatstone. Autumn of 1839.
		Third English Patent.
		Third Mechanical Telegraph.
	L	Escapement with one magnet and two wires.
		Principles,—
		I. Giving signals by a revolving dial fixed on the arbor of an escapement wheel, which is moved by a maintaining power on the removal of an alternating escapement detent, by the alternate attractive force of a magnet and the reaction of a spring.
		II. Ditto, ditto, moved by the alternate attractive force of a magnet and reaction of a spring, without maintaining power, adapted for domestic use.

PART L.—DRAWING 7—*continued.*

Old.	Improved.	New.	
			Principles— <i>continued.</i>
			III. Capstan communicator, effecting, by a revolving motion, the breaking and renewal of the current corresponding with the alternating movement of the escapement.
			IV. An alarum detent, removed by the blow of a hammer (worked by maintaining power) transmitted to detent, when required, by a magnetic needle interposed by an electric current between the hammer and detent.
			V. Substitution of the magneto-electric machine for the voltaic battery.
			<i>Vide</i> Drawings of Third English Specification for further details.
		B, C, L,	- - B, C, L. Reciprocal mechanical communicator applied to the alternating action of the escapement instrument, including the principles of B and C, with the exception of the self-acting cross-piece.
Fig. 1 B			
Fig. 2 B			
Fig. 2 K	- - -	- - -	Fig. 2 K not represented.
3 b, 3 C			
4 B, 4 C			
5 C, 5 c			
8 B, 8 C			
8 c, 8 c c			
10 D			
11 B	- - -	- - -	- - 11 B. Occasional cross-piece requiring to be set at the conclusion of each communication before a reply can be returned.
12 B			
13 C, 13 D			
14 C, 14 c			
14 c c	- - -	- - -	- - 14 c c. Instead of brass pins to prevent the contact between the magnet and armature, a shoulder on the spindle of the armature effects the same purpose.
15 C			
15 c			
16 C			
16 c			
16 D, 17 C			

PART L.—DRAWING 7—*continued.*

Old.	Improved.	New.	
19 D	18 L	- - -	18 L. Revolving capstan communicator.
	18 l	- - -	- - 18 l. Signal-plates dividing the revolving communicator into equal parts and breaking the current alternately, each plate corresponding with its appropriate key, and with the signal on the dial to be given by that key.
	31 L	- - -	- - Magnetic needle, sounding alarum by its interposition between the detent and a hammer worked by maintaining power.— <i>Vide</i> Drawings of Third English Specification.
		32 L	- - Adaptation of the magneto-electric machine for giving signals. This has been the subject of experiment since March 1836, but was first successfully applied by Professor Wheatstone.— <i>Vide</i> Drawings of Third English Specification.
		33 L	- - Attraction of an electro-magnet and reaction of a spring, employed to give signals without maintaining power.— <i>Vide</i> Drawings of Third English Specification.
			<i>N.B.</i> —The communicator of Part E is introduced into this drawing to show the close resemblance which Part L bears to it, both in principle and arrangement, the main difference being, that in part E the communicator was worked by a maintaining power; in part L, by the hand.
			<i>N.B.</i> —The diagrams in Drawing 7 are intended only to illustrate the principles on which the different instruments act, not the instruments themselves; for which, <i>vide</i> Drawings of the Third English Specification.

PART M.—DRAWING 7.

Old.	Improved.	New.	
			<p>Mr. Cooke. After the middle of Nov. 1839.</p> <p>M. Fourth Mechanical Telegraph, escapement with two magnets and three wires, acted upon by a constant electric current.</p> <p>Principles,—</p> <p>I. Giving signals on a fixed dial by a revolving index-hand fixed on the arbor of an escapement-wheel moved by a maintaining power, on being stopped by the retentive attraction of one of the two voltaic magnets acting upon the alternating escapement detent.</p> <p>II. Portable telegraph, requiring no battery to be carried with it, and adapted for working in both directions at the same time.</p> <p>III. The application of a constant current to telegraphing.—<i>Note.</i> Professor Wheatstone has claimed this principle as an unapplied idea of his own, and Mr. Cooke has yielded to this claim, which, however, has never been proved. Mr. Cooke cannot remember any instrument or plan in which Professor Wheatstone proposed using the constant current.</p> <p>IV. Self-acting telegraph, on the principle of Part M, the hand being fixed to the arbor of the escapement; adapted for tunnels, crossings, and approaches to stations; enabling a train to give notice of its own approach in any direction; also adapted to give more signals when required, by a hand fixed on a second wheel. <i>Vide</i> Drawings 8 and 9.</p> <p>V. Air-pressure apparatus, for keeping the inner surface of the tube under constant pressure, and, by adapting the degree of pressure to circumstances, enabling the tube to be carried safely under water. A barometrical detector will indicate, even during dry weather, any unsoundness of the tubing, which hitherto</p>

PART M.—DRAWING 7—*continued*.

Old.	Improved.	New.	
			Principles,— <i>continued</i> .
			has been indicated only by the interruption to the signals caused by the admission of wet. A portable detector can be applied at each proving-box. The air-pressure apparatus may also be used for forcing dry air through the tube to remove any dampness that may exist.— <i>Vide</i> Drawing 9.
		B, C, M	-- B, C, M. Reciprocal communicator, as adapted to Mr. Cooke's third mechanical telegraph, as described in the third English patent, including all the principles of B, C.
Fig. 1 B Fig. 2 B Fig. 2 K 3 b, 3 C 4 B, 4 C 5 D 8 B	8 M	- - -	-- 8 M. The connecting wheel of the communicator, by which the telegraph wires of 4B, 4B are brought into connexion with the pole-bar 3 b.
10 D 11 C	- - -	- - -	-- <i>Note</i> , 11 C, the self-acting cross-piece, is the same piece of metal as 8 M, by which the telegraph wires 4 B are connected with the pole-bar 3 b. In the portable telegraph 26 M, this wheel is in duplicate, and partakes of the character of 27 M, or current director.
	11 M	- - -	-- 11 M. Self-acting cross-piece of "engine-warner," fig. 35 M M.
12 B 13 D 14 c, 14 c c 14 D, 14 d 16 D 16 c 17 C	- - -	18 M	-- 18 M. Revolving communicator concentric with the signals and fulfilling all the conditions of B C in the most efficient manner, whether applied to terminal, intermediate or portable telegraphs, and capable of working the portable telegraph without a distinct battery.
19 D 23 H	- - -	21 M	-- 21 M. The constant circuit applied to the principle of Part M.

PART M.—DRAWING 7—*continued*.

{Old.	Improved. ⁹	New.	
	Fig. 26 M	- - -	-- Fig. 26 M. Portable telegraph, not requiring a distinct battery.
	27 M	- - -	-- 27 M. Current director, as applied to the peculiarities of the constant circuit in the portable telegraph.
	28 M	- - -	-- 28 M. Mile-post arrangements, adapted to Part M.
29 K 30 K Fig. 31 K	- - -	34 M	-- 34 M. The escapement telegraph, experimented upon in 1836, and now, by certain new inventions (described in the third English patent), rendered a practical telegraph of simple and certain application.
			<i>N.B.</i> —For further details, <i>vide</i> Third English Specification.
		Fig. 35 M M	-- Self-acting telegraph, giving 2 signals by an index fixed on the pallet arbor acting on an excentric scape-wheel, as applied to the "engine-warner" for tunnels, &c., and adapted for giving additional signals by a second hand, when required.
		36 M	Engine-warner.
		36 m	-- Lever arm of warner, breaking the electric circuit, and causing signal to be given on the approach of a train.
		37 M	Application of air-pressure apparatus.
		38 M	-- Barometrical detector, for discovering injury to the tubing.
			For further description of fig. 35 M M, 36 M, 37 M and 38 M, <i>vide</i> Drawings 8 and 9.

DRAWING 8.

Fig. 1.

Application of ELECTRIC TELEGRAPH to Tunnels.

- 1 A, 2 A. Telegraphs fixed in policemen's boxes near the mouths of tunnels.
 B, B. Intermediate telegraphs near the shafts within the tunnel, always ready to work with 1 A, 2 A, in case of need.
 C. Protecting tube for conducting wires.
 C E, C E. Tube leading to engine-warner ; *vide* Figs. 2 and 3, with explanation.

Fig. 2.

Application of ELECTRIC TELEGRAPH to Level Crossings, Approaches to Stations, and Switches, &c.

1 A, 2 A, 3 A. Telegraphs fixed in policemen's boxes, one or two miles from a level crossing or station.

C. Protecting tube for the conducting or telegraph wires, either carried on posts with a railing over it or under-ground.

D. Telegraphs at stations or level crossings, corresponding with 1 A, 2 A, 3 A.

1 E, 2 E, 3 E. "Engine-warners," (for details, *vide* Figs. 3 and 4) by which an engine gives notice of its approach, at the distance of one or two miles, both to A and D. If the station or crossing be clear, D replies to the policeman at A to allow the train to "Go on;" or else to "Stop," according to circumstances; the engine-man never venturing to pass A till the policeman had given the signal for "Go on." This will ensure the watchfulness of the policeman; but even in case of his absence, the conductor would inquire by the telegraph A for permission from D to proceed. In the figure, the policemen at 1 A, 2 A have received permission from D (as is indicated by the pointing of the handles of the telegraphs at D, corresponding with the indications on the telegraph both at D and 1 A, 2 A) to allow their respective trains to proceed. The policeman notifies in the usual manner, by the white flag or signal, that the line is clear. The train 3 e has been stopped by the policeman at 3 A, in obedience to a signal from the station D, in reply to the "warning" given by the engine of its approach from 3 E.

N.B.—The signal given from the "engine-warner" E, at A and D, is, "Stop," accompanied by the ringing of an alarum. This signal remains till answered from D.

Fig. 3.

Telegraphs for giving two signals, as represented above at A, B, and D, each having an alarum (a), which sounds when a signal is given either from E, D, A, or B.

N.B.—Thirty telegraphs, giving two such signals, are working from Eight in the morning till Ten at night on the Blackwall Railway incessantly during the day.

Fig. 3 E.

Represents the details of the "Engine-warner."

An upright bolt passes through one rail of the "approaching line" of road, the upper end rising slightly above the rail, so as to be depressed by an engine-wheel, or other very heavy body passing over it. The lower end of the bolt rests upon the arm of a lever supported by a spring capable of offering a resistance equal to at least half the pressure of one wheel of a carriage.

Upon a train passing, one arm of the lever is depressed, which raising the other arm, breaks the electric circuit at e, and causes the alarm to be sounded and the warning signal to be given at A and D; the other wheels of the train produce no further effect till the warning has been replied to from D, which at the same time restores the electric circuit of the "warner" for another signal. Though the "warner" might be let off by mischievous persons with a crowbar, &c., no inconvenience would be occasioned beyond arousing the expectation of the policeman for the time occupied by a train in passing the space between E and A, when the fact would be discovered, and reported by a signal to D. The object of the "warner" may obviously be attained by a variety of simple mechanical means.

DRAWING 9.

Fig. 4.

1 F, 2 F. Terminal Telegraphs, for more extensive communications than those already described, giving 30 or 60 signals by the pointing of a revolving index-hand at letters on a fixed dial, as in a common clock; the person giving the signal turns the concentric hand (t) till its pointer stands opposite the signal to be given, as shown in 1 F, when, instantaneously, the index-hand (g) in all the corresponding telegraphs in the circuit, viz., 1 F, 2 F, 1 G, &c., point at the same signal. 1 G is an intermediate and portable telegraph, to be carried with each train, and applied, in case of need, to convenient arrangements at each mile-post or bridge along the line. The section of a railway below Fig. 4 illustrates this subject. An iron cap to the mile-post being unlocked and taken off, the portable telegraph is placed within a ledge fitted to receive it, and thereby makes the necessary connexions with the conducting wires, and is at once fit for working with the "terminal telegraphs." This form of telegraph can be worked by any person at first sight, and requires no battery to be carried with it. It is fitted up with a water-proof cover and lantern, for rainy weather and night use.

N.B.—All forms of this electric telegraph are "reciprocal," *i. e.* they give the same signals in the working as in the recipient apparatus, and work equally from either end or from intermediate points.

Fig. 5.

Represents a very simple form of Telegraph, on exactly the same principles as Fig. 3, Drawing 8, and Fig. 4, Drawing 9, but combining the powers of both; the arrow giving two signals, for the purposes explained when applied to tunnels,

level crossings, &c., and the small index K being adapted for a more extensive communication, when circumstances require it.

Fig. 6 M.

Is the Electric Detector, for detecting injury caused to the wires, either by contact with the pipe or with each other, fracture, or water; m, is a small battery.

1 m, 2 m, are provers, in connexion with the battery and detector. Whenever these provers touch each other, an electric current passes from the battery and influences the index of the detector M, by turning it on its axis. J J are iron boxes which occur at short intervals along the line, each fitted with a screw lid, and so connected as to render them continuous with the tube C. The terminations of each length of wire-rope are introduced into the box, and each wire screwed with its fellow to a piece of wood fitted to the bottom of the box, so that the wire marked 1 is continuous throughout its length and always connected by the screw 1, by which it can be recognised at every box along the line. The openings by which the wires enter the box are hermetically sealed with composition; but a small tube (C) passing through the box admits of a free communication of air from the distant reservoir. Suppose wire 1 to have become in partial contact with the tube, either by the metals touching or the presence of water. Upon opening the box at which the wire is to be proved, the screw 1 must be taken out, and the prover, 1 m, brought in contact with one end of the separated wires, the other prover being kept in contact with the pipe. If this portion of the conducting wire is sound, the detector needle remains stationary; but upon removing the prover, 1 m, to the other liberated end of wire, the detector index moves on its axis, and indicates on the graduated scale the degree of contact existing between that portion of the wire and the tube. Supposing the experiment to be tried again at the next box, and the contact proved to lie between the two boxes, the intervening faulty portion of wire is exchanged for the sound wire marked 0; (which is a spare wire introduced for such repairs) by this means the wire 1 is again restored to soundness; it is obvious that different portions of the spare wire, 0, may thus be employed to repair a damaged wire, at numerous short intervals along the line, without rendering it necessary to disturb the line generally; the minutest changes in the insulation of the wires from dampness, &c. can be detected by this valuable instrument, and corrected by blowing through the pipe a draught of dry air from the reservoir.

When a length of wire-rope has to be removed, in consequence of accidental injury, the connecting screws in the boxes at each end of the length are taken out, and one end of the wires to be removed is bound to the end of a fresh length of wire-rope conveniently wound upon a drum. The further end of the faulty length is then drawn out of the tube and wound upon an empty drum, as the new rope gradually takes its place. The screws again unite the wire-ends, and the line is restored. The faulty length, after undergoing examination and repair, is again fitted for use.

Each wire is separately covered with cotton and India-rubber solution, and the set of wires made into a rope, which is passed through a hot resinous varnish before being introduced into the tubes.

Fig. 7.

Air-pressure Apparatus, employed for excluding water from the tube, when carried under-ground; and giving notice of defects in the tubing.

H is an air-pressure apparatus, or air-reservoir, of convenient size, charged with dry air to any pressure; say two or four pounds. 1 h is a pressure balance, in the form of a lever; 2 h, a valve communicating between the reservoir H and the protecting tube C. Suppose it to be found desirable to keep the interior of the tube under a pressure of two or three pounds (that being calculated as sufficient to exclude the greatest pressure of water to which the tube is liable), the balance 1 h must then be loaded to that amount; on any escape of air taking place from the tube, the lever arm, 1 h, would descend, and open the valve 2 h, till the high-pressure reservoir had increased the pressure in the tube, which by raising the pressure balance 1 h, would close the valve 2 h. A barometer, L, may indicate the change of pressure either in the reservoir or tube. The reservoir is supplied by an air-pump, when nearly exhausted by any leakage, which under the light pressure of three or four pounds should be very trifling. Should the barometer, however, indicate a sudden escape of the air, attention must immediately be directed to the proving-boxes, J, which occur at short intervals along the line.

In or near the box, conveniently connected with the tube, is a three-way stop-cock, to the pipe of which a portable barometer or detector, L, can immediately be applied. When the tube is faulty, upon turning the cock in one direction, the pressure on the barometer will remain steady, but in the other direction it will rapidly diminish, from the escape of the air. By proceeding with a similar experiment at other proving-boxes, the two boxes will be quickly ascertained between which the escape of the air takes place; when the tube lying between the last-proved points must be carefully examined, to discover the faulty part.

MR. COOKE'S PAMPHLET OR SKETCH OF 1836.

PLANS for establishing on the most extensive scale, and at trifling expense, a rapid Telegraphic communication for political, commercial, and private purposes, especially in connection with the extended lines of railroads now in progress, between the principal cities of the Kingdom, through the means of electro-magnetism, by W. F. C.*

The Inventor of the instrument and system which are the subjects of the following pages has availed himself of an idea suggested many years ago by a Mr. _____ of _____ and since renewed by Professor Weber of Göttingen under a varied form. Mr. _____ proposed to convey along isolated wires, a series of electric shocks, which according to their number would have reference to a signal key of letters or sentences &c. Professor Weber in 1832, struck by the amazing rapidity with which a suspended magnetic

* This early pamphlet or sketch is the subject of Dr. Reynolds' letter of the 26th January 1837, given in a note to Mr. Cooke's Pamphlet of 1854.—*See Part I. p. 29.*

needle obeyed the impulse of a galvanic current conveyed along a great length of wire, proposed employing it for telegraphic purposes: the easterly and westerly deviations caused by reversing the direction of the current offering an alternation of two symbols. The apparatus hereafter mentioned is worked on a different principle altogether, the galvanic agency being however still employed.

The national importance of some practicable method, by which the benefits of a rapid telegraphic communication may be extended at a cheap rate to political and mercantile affairs, and in all cases of emergency to the private concerns of individuals is too obvious either to require argument or admit of question: and it seems only to be needful that a clear statement should be given of the manner in which this object may be attained, to ensure general encouragement and support for the execution.

Improvement, however, which in every other department involving the convenience and exigencies of society, has, especially of late years, made the most rapid and unexampled progress, we find inactive here.

The enormous expence attending the present system of telegraphing, whilst it offers an insuperable obstacle to the establishment of a line of telegraphs for any objects, but such as are of the most essential importance, is felt even by Government as a sensible weight in the short line between London and Portsmouth, the solitary instance in which

it has been called into action even in affairs of state.

This expensive system labours also under the following very serious deficiencies and imperfections, which, necessarily arising from the principles on which it is framed, admit of no remedy.

I. The present telegraph is only available during day-light, *i.e.* during less than one half of each day upon the yearly average.

II. Even during day, it is dependent upon the weather, being interfered with in its action by partial rain, storms, morning and evening mists, and those dense fogs to which our climate is peculiarly liable during the short days of winter, when for weeks together its use may be suspended entirely.

III. The utmost vigilance is constantly required at each station; yet, along extended lines, communications are forwarded with slowness and uncertainty, in consequence of which, a degree of brevity often objectionable must be observed in the dispatches.

IV. The symbols are publicly displayed, and their meaning thereby rendered liable to detection; a circumstance which has on many occasions led to the publication of the secrets of government.

The system here advanced causing expense so small as to bear no comparison with that now incurred, and effectually supplying the deficiencies, and avoiding the imperfections above mentioned,

offers advantages to the public as well as the Government which it is hoped are not unworthy of consideration.* The Electro Magnetic Telegraph which the writer has invented for this purpose is small, compact, and portable, yet very strong in its construction; is unaffected in its action by darkness, or any obstacles of the atmosphere: the first signal being an alarum, which continues its call at intervals till answered, demands no vigilance: its action at any number of connected towns,† stretching from one end of the kingdom to the other, may be considered as simultaneous, since the electric fluid traverses many hundred miles in a time too short to be appreciated: it ensures correctness in the notices given, being so arranged, that each signal to be represented to others, is, at the same instant, presented to the eye of the signalizer: it precludes the possibility of any but confidential clerks seeing the symbols given, and to which, when requisite, they would have no key. Lastly, as an advantage peculiar to itself, this instrument, by the instantaneous transmission of notices, sets the most broken dialogue on the same footing with a single dispatch. Though not impracticable before, it may perhaps be said that by this system Telegraphic Dialogue is introduced.

For the execution of this plan, the only requisites are, that one of these instruments be kept at each of any number of towns, between which

* *Vide* Note 1 (page 260, post).

† *Vide* Note 2 (page 260, post).

intercourse is to be carried on, and that two copper wires* properly defended, be laid in the earth, along the intervening line of road, by which the instruments may be connected with each other, and the telegraphic notices conveyed. Admitting the capability of the instrument, and the correctness of the principle, yet two apparent difficulties in the execution of the project, will naturally suggest themselves to the reader, viz. :—

1stly. The liability of small copper wires extending for some hundreds of miles to receive injury : and,

2ndly. The difficulty of determining the place where such injury has been received.

Since any serious inconvenience here would, indeed, form a weighty objection against the system, it may be as well to consider how these difficulties may be effectually obviated, before proceeding further. Injury to the wires may result, either from,—

I., a gradual decomposition of the metal ;

II., a fracture, owing to the partial settling of the ground ; or,—

III., external violence — either accidental or designed.

I. Copper, as is proved by the perfect state of ancient coins, which have lain buried for ages, is subject to very slow decay, and the protecting

* *Vide* Note 3 (page 260, post).

trough already described, by guarding the wires from moisture and air, would effectually preserve them.

II. along old-established roads, and below rail-roads now forming, no settling of the old soil would occur, but to avoid ill effects, where the soil is not consolidated, and to admit of contraction from change of temperature, the wires would be laid with a sufficient degree of laxity to allow of moderate elongation without exerting tension on the metal, which, from its softness and toughness, is nevertheless capable of supporting a very considerable strain.

III. From external violence of an accidental nature little apparently need be feared,* and it may be difficult to suppose any so great, as to form a probable cause of injury to the wires at a depth of two feet below the surface of the ground. Against such as is designed, the ordinary precautions can alone be resorted to. It may be observed of both these cases, that the road would, on a careful inspection, (conducted on a plan presently to be described), offer such marks as would immediately point out where the injury had taken place.

To proceed to the second subject of consideration proposed, viz., the providing a sure, speedy, and simple method of discovering the injured point in every case.

For this purpose short branches will be given off from the main wires, opposite to turnpikes on com-

* *Vide* Note 4 (page 261, post).

mon roads, and station-houses* on railroads, into which buildings the extremities of the wires will be carried, and there secured in a lock-up box, or closet in the wall, of which the district inspector will have the key. He will be furnished also with a simple electro-magnetic † instrument about the size of a watch, containing a poised magnetic needle; upon connecting this instrument with the terminations of the branch wires, or with the main wires themselves, in the manner described in the note, (the telegraphs being set as directed) it becomes immediately evident by the deflection of the needle, on which side of the place of experiment the wires have been injured. As soon as the connection between two telegraphs is found to be broken, the inspector will proceed to discover by successive experiments, the two consecutive turn-pikes, or station-houses at which the effect on the needle is reversed. The injured point must evidently be somewhere in the interval between them; his next step will be to examine the intervening ground to discover if there be any external marks to direct his further search; if none appear, he will divide the interrupted distance, (which we will assume as 12 miles) and cause a

* N.B.—By station-houses may be understood, all buildings connected with railroad lines, whether depôts, &c. near towns, or watch-houses, where the main-roads are crossed, &c. &c. These generally occur at far shorter distances than 12 miles.

† *Vide* Note 5 (page 261, post).

hole to be sunk to the conducting trough, when the former experiment will be made upon the main wires: this halving of the intervening space if repeated 12 times, will reduce the unexamined distance from 12 miles to 5 yards. Whilst at each examination, the attention being directed nearer and nearer to the object of search, the probability of detecting external marks of violence will be increased; thus, a very few hours from the discovery of the interruption will, under the most unfavourable circumstances, be sufficient to admit of the injury being detected and repaired.

Since such injuries could only be of very rare occurrence, the ready method thus afforded for detecting and repairing them renders this very trivial liability unworthy of further consideration, and forbids its being viewed as any objection to the system.

Having obviated these apparent difficulties, we now proceed to notice some further advantages arising,—

1st. From the nature of the instrument.

2ndly. From the extended application of telegraphing, which it renders practicable.

Hitherto *signals* very slightly differing from each other have been used in telegraphing, to represent either the letters of the alphabet or numbers, corresponding with the signal key. In the electro-magnetic telegraph, the characters represented amount in all, as has been already stated, to 60, consisting of 22 letters, viz., A, B, C, D, E, F, G,

H, J, K, L, M, N, O, P, R, S, T, U, W, X, Y.;
 10 English digits, viz., 1, 2, 3, 4, 5, 6, 7, 8, 9, 0,
 representing amount; 10 numbers, viz., I. II. III.
 IV. V. VI. VII. VIII. IX. O. in reference to the
 signal key.

14 symbols, viz., £, s, d, ÷, ?, ?, ,, ,, ,, &c,
 &c., $\left(\begin{smallmatrix} \text{private} \\ \text{symbol,} \end{smallmatrix} \right) \left(\begin{smallmatrix} \text{government} \\ \text{symbol,} \end{smallmatrix} \right)$ and any other 4
 symbols which may be found the most convenient
 for practical purposes, making 60 the total.

NOTE.—It is found convenient to repeat the ?
 and ,. ÷ is a fractional sign, as $1 \div 2$, or $\frac{1}{2}$.

From 1,000 to 1,500 of these characters may be
 represented in an hour, so that with an extensive
 and well selected compilation of sentences, questions
 may be put and answered, advice asked and given,
 and consultations of every kind carried on with no
 further loss of time, and sometimes even with less,
 than would be requisite for making the same com-
 munications to the deaf and dumb, by talking on
 the fingers.

This advantage, which is great even at comparative-
 ly short distances, increases incalculably in import-
 ance when the places are very remote from each other.

The precision and certainty of the instrument
 are also deserving of observation. It is worked in
 a very simple manner by 16 keys or stops: each of
 these keys has the particular characters inscribed
 upon it, which the instrument can be made to
 represent by its action, and these characters are
 arranged in such positions as to indicate the direc-

tion in which the key must be moved for the representation of each. The greatest possible security is thus afforded that the attentive signalizer will without fail represent the character which he intends. Again, each character is about half an inch in diameter, so as to be perfectly distinct, and only one character being visible at a time, precludes any doubt in the clerk receiving information, whose sole business it becomes to copy down the several characters which are successively presented to his eye. Lastly, this one character being simultaneously represented on both instruments, the signalizer, if by accident he have laid his hand upon a wrong key, immediately observes his error and will correct it by the following signal.

Inscrutable secrecy is obviously of primary importance in the mass of telegraphic correspondence. This may, on a *primâ facie* view, appear a difficult object to obtain, where the symbols are seen by a number of persons at the same time without each corresponding party having a private signal book : but the accompanying "Round-Robin" cypher* will at once show from the innumerable changes, of which it is capable, that a published signal book may be employed on the most private occasions. These changes depend upon the fresh relative arrangement of the circle containing the letters, to that containing the figures, each time of the cypher being employed, however frequently it may be required during the day.

* This cypher has been lost.

To illustrate this, suppose a card published with each signal key, with the letters and numbers in the order of the annexed cypher. A London banker in the habit of communicating on all extraordinary occasions with his country agents by telegraph, would furnish each of them with a private memorandum, of which he would keep a copy, to this effect (in adjusting the cypher).

Mr. J., Liverpool, No. in signal key 3742, set 1st signal given to the day of the month.

Mr. P., Glasgow, No. 2314, set 2nd signal to the day of the month.

Mr. D., Edinburgh, No. 143, set letter H to the day of the month.

Mr. X., Dover, No. 415, set 7 to odd days of month, VII. to even, &c.

And so on with an endless variation, to which the most extensive correspondence would give no clue.*

Suppose the correspondence then to run thus:—

(Private symbol)	L L	3742	} 782,641,39 ? £42 5 6½ Stolen.
(Private symbol)	G	2314	

The cypher transpositions would stand thus on the

1st January, { if to Mr. J.
 { if to Mr. P.

2nd January, { if to Mr. J.
 { if to Mr. P.

(Not filled up in the manuscript.)

* NOTE.—Short expressions, such as “I,” “and,” “to,” “by,” “of,” “you,” should always be avoided in cypher correspondence, as affording an easy clue to a certain number of letters.

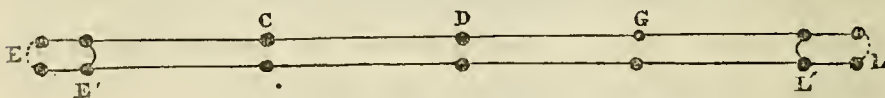
At first, this may appear difficult to transpose from the cypher card, but a very little practice gives great facility.

We proceed to consider the application of this system to the affairs of Government ; of the commercial world ; and of the private individual.

I. Application to the affairs of Government :*—

It will be generally acknowledged that an enterprise of this description, though carried into execution by a company, should always be under the control of the Government. That in case of dangerous riots or popular excitement, the earliest intimation thereof should be conveyed to the ear of Government alone, and a check put to the circulation of unnecessary alarm. From the construction and character of the Electro-Magnetic Telegraph, great facility is given to the exercise of this control when requisite, without interfering with the enjoyment by the public of its fullest advantages on ordinary occasions. Let Government be supposed in possession of a distinct telegraph at either end of the line, when, by a single movement, the communication between the public telegraphs may be cut off.

Suppose E, L to be the public telegraphs at Edinburgh and London respectively ; E', L' the Government telegraphs at those places ; and C, D, G telegraphs at intervening towns ; when the signal, " Government dispatch for London "



* Vide Note 6 (page 263, post).

is passed from E' to L' , the connexion between E' and E and between L' and L will be immediately broken off, as the act of giving the signals, "Government dispatch for London," from the telegraph at E' , breaks off the communication between E' and E ; and, as the Government telegraphs will be differently arranged from those in public use, the communications that followed would be unintelligible at the places C, D, G . On lines along which Government dispatches are most frequently transmitted, it might be desirable to lay down a distinct set of wires for that use, which would also diminish the risk of the communication being entirely interrupted by the accidental breaking of a wire. The wires of the public télégraph might then pass through the Government office, and be applied to the Government instrument at pleasure, when the usual arrangement of the signals could be restored. Commanding, by these means, immediate and sole intelligence of disturbances, &c., in distant parts of the kingdom, the Government would be enabled in case of disturbances to transmit their orders to the local authorities, and, if necessary, send troops for their support; whilst all dangerous excitement of the public might be avoided.

II. Application to commercial affairs:—

The advantages under this head are no less comprehensive and important. An immediate knowledge of the daily state of all the important markets &c., would place the most distant cities of the king-

dom on a footing in their mercantile transactions with the capital. The daily state of the money market, so eagerly expected on the stock exchange of London, would be looked for with equal anxiety at Liverpool, Glasgow and Newcastle at the same moment.*

The security and confidence inspired by an actual knowledge of the existing state of things, would give a fresh spur to activity in all honorable mercantile transactions; whilst the unfounded reports now circulated by the swindler could no longer produce their effect. The capitalist of Glasgow might, without fear of an unfavourable change of price taking place during the interval, transmit to his agent in London orders for the immediate sale or purchase of stock or shares; and the banker of the country, when pressed in time of panic, might be preserved from stopping payment, by assurance from the capital of extended credit. The offerer of false bills, on the other hand, would be in more dangerous circumstances, when his guilt might so soon be proved; and the culprit, escaping from justice, might be anticipated by intimation to the authorities on the coast.

For security against unfair dealing and neglect, copies of all communications given in for transmission at the office would be kept for the reference of subscribers, with date of the day and hour at which they were forwarded and received, and the

* *Vide* Note 7 (page 264, post).

originals countersigned as entered would be returned; where unjustifiable delay or carelessness in forwarding the same was proved, the clerk would be subjected to punishment. This, and other obvious regulations (not necessary to transcribe here), would ensure the same accuracy in the telegraph which has established the character of the Post Office.

III. Application to the affairs of individuals:—

The cases in which the convenience of individuals would be affected are innumerable; and perhaps there are few persons, however generally unconnected with the transactions of the busy world, who would not sometimes be spared either a lengthened epistolary correspondence or an expensive journey, by a few short communications through the telegraph. The comfort of friends and relations, far distant from each other, would often be materially involved, especially in cases of sickness; and it may not be too much entering into detail to specify that particular instance, where sickness appears hastening towards a fatal termination with such rapidity that a final meeting is without the range of ordinary means. Though the application of the telegraph to private affairs is less dazzling than that to Government and commerce, it is perhaps not less intrinsically valuable as equally tending towards the one and only justifiable object of all establishments—the aggregate of comfort and happiness to the nation. It may here be observed, that should it at any time be desirable for the Admiralty, in their com-

munications with vessels lying off telegraph ports, to convey their dispatches direct during the night, the apparatus in ordinary use, conveniently situated facing the sea, may, by a peculiar adaptation of the hydro-oxide lime burner, arranged for this instrument, extend their correspondence many miles across the water. Even His Majesty's navy might be furnished with instruments of a simpler arrangement than that proposed for land service, to communicate signals during the night, the action of which would not be interrupted by the motion of the vessel during bad weather. For short distances of a few miles, a powerful argand lamp would answer this purpose effectually. We will specify one further instance nearly allied to many others, in which this telegraph might be advantageously employed. It is observed by Dr. Lardner, in his work on the steam engine, at the 219th page, when speaking of the inconvenience to which locomotive engines are exposed in surmounting inclined planes on railways, that "a subsidiary, or assistant locomotive engine, may be kept in constant readiness at the foot of each incline, for the purpose of aiding the different trains as they arrive, in ascending. The objection to this method is the cost of keeping such an engine, with its boiler continually prepared, and its steam up. It would be necessary to keep its fire continually lighted, whether employed or not; otherwise, when the train would arrive at the foot of the incline, it should wait until the subsidiary engine was prepared for work." This plan is adopted.

How soon would the proprietors of railroads be repaid for laying down wires along a few miles of road leading to such ascents, by which timely intimation of the approaching train might be forwarded to the engine-man, with notice to prepare? and how effectually would this remedy the costly inconvenience described?

Lastly, consider the sources whence a revenue, adequate to defray the original outlay and current expenditure of such an enterprise, may be derived. If a company undertake the execution, under the control of Government, a proportionate remuneration for the forwarding of official dispatches may be expected from that quarter. In each town where a telegraph was established, various classes of subscribers would be admitted to the privilege of receiving and forwarding their private correspondence, and of being made immediately acquainted with the general news of the day. These might consist, 1st—of perpetual subscribers or shareholders, admitted to the subscribers' room, where all general, political, and mercantile news would be published as soon as received. 2ndly—Annual subscribers. 3rdly—Temporary subscribers for some special purpose. 4thly—The occasional subscriber for a single dispatch. Each of the three former, in addition to his subscription, would pay, on employing the telegraph, according to a fixed scale, proportioned to the length of the dispatch and the class to which he belonged.

If any interference, which an extensive establishment of this telegraph might create with the Post

Office, be viewed as an encroachment upon the revenues of Government, it will be remembered that communications by telegraph may be taxed as well as those by post; and as this interference would be almost insensible in any case, Government would gain, not lose, by the event.

The writer does not propose to go into a lengthened statement of the minor details of his plan on the present occasion, but to give only such a sketch as will enable the reader to form a general idea of it as a whole.

It may, however, be desirable to explain the nature of the signal-key which he purposes employing, although perhaps offering nothing new in its design.

The numbers in reference to the signal-book, it has already been explained, will be formed on the telegraph, in the Roman character (or else broad printed type) for the purpose of distinction.

The signal-book or key might advantageously have two sets of numbers; the first, for general use, in reference only to daily reports, sentences, words, &c.; the second, which would be indicated by the signal (private) preceding them, might be appropriated to the names and directions of subscribers. Hence, a telegraphic notice commencing with (private), followed by a number, would intimate that the symbols following, after being taken down and copied into the day-book, should be forwarded in the usual way to the person whose address that number signified: when followed by the signal

{express), an additional charge would be made for dispatching it on the instant. An abbreviated mode of spelling (a kind of short hand) would generally prove more expeditious for the public office than the employing numbers to express single words. The towns would be most easily recognized by their initial letters; and when on the same line two telegraphic towns commencing with the same letter occurred, one might be designated by both the first and last letter, as L. for London; L. L. for Liverpool; N. for Newcastle; N. M. for Nottingham, &c. A clearly-printed list of these abbreviations and their meaning, together with the numbers of daily reports, might be fixed before the clerk attending the telegraph for ready reference. When, if at Leeds, on the York and Liverpool line, he saw, after the alarum had sounded and been answered, the letters L. L. follow on his telegraph, he would leave the further attendance on the signals to his compeer at Liverpool.

The duties of a clerk of the telegraph would be extremely simple, requiring only accuracy and attention in noting down and transmitting notices, with a certain degree of expertness easily attained in working the instrument.

These qualifications are frequently possessed in a remarkable degree by a very deserving class of persons, to whom our state of society has hitherto assigned no congenial occupation.

The deaf and dumb might, in the telegraphic department, find employment peculiarly suited to

their education and powers. Accustomed from their infancy to abbreviate as far as possible, by signs, their symbolic language, they would quickly attain a degree of conciseness in spelling, which, in addition to the omission of the smaller words, would enable them to transmit with astonishing rapidity a lengthened dispatch: whilst a habit of attention enforced by their infirmities would be favourable to the accurate performance of their duties.

The idea of uniting a great political and mercantile enterprise with a charitable object may excite a smile, but cannot diminish the value of the undertaking in the eyes of those, whose support the writer is most anxious to ensure. It may be observed that a method as effectual as the alarum for those who can hear, may be employed in connection with this instrument to awaken the deaf from the soundest sleep.

A general outline has now been given of a system by which the knowledge of passing events may be propagated instantaneously to distant parts, together with a view of some leading advantages which may reasonably be expected to result therefrom.

To what the introduction of this system may eventually lead, the writer does not venture to predict, but concludes these observations with the following quotation from Dr. Lardner's work already mentioned, a passage which may be applied to the action of the Electro Magnetic Telegraph as forcibly as to that of the steam engine,

and, indeed, corresponds most happily with the united action of both. It runs thus,—

“The moral and political consequences of so great a change in the powers of transition of persons and intelligence from place to place are not easily calculated. The two advantages of increased cheapness and speed, besides extending the amount of existing traffic, call into existence new objects of commercial intercourse. The concentration of mind and exertion, which a great metropolis always exhibits, will be extended in a considerable degree to the whole realm. The same effect will be produced as if all distances were lessened in the proportion in which the speed and cheapness of transit are increased. Towns at present removed some stages from the metropolis will become its suburbs; others, now a day’s journey, will be removed to its immediate vicinity; and business will be carried on with as much ease, between them and the metropolis, as it is now between distant parts of the metropolis itself.”

NOTES.

I. This instrument is capable of representing in rapid succession, sixty letters, figures, and symbols, with a distinctness which admits of no mistake.

II. Any number of instruments may be attached to the same conducting wires. Hence, if telegraphic intercourse is to be established between two distant places, the wire laid down for this purpose, may be connected with an instrument at every town which it visits throughout its course. In such combinations, whatever symbol is represented on any one instrument immediately presents itself on all the rest.

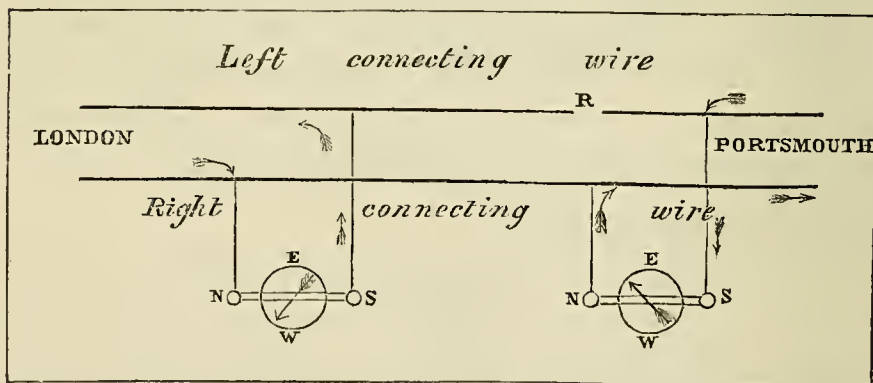
III. The following plan for the construction of a conducting trough is recommended by the projector, as the cheapest and most durable which has occurred to him, offering, at the same time, an

effectual mode of isolating the wires and of protecting them from decomposition. He proposes that the wires be laid in separate channels formed along the surface of narrow slips of baked wood, and covered in with a thin lath of the same material, and that this case be inserted into a trough of thick semicircular draining tiles about 3 or 4 inches diameter, the space between the wood and tile being filled with waterproof cement, the whole may be guarded above by a flat tile, and buried from 18 inches to 2 feet in the ground.—Through large towns, where the streets are frequently disturbed for the laying of gas or water pipes, iron pipes (the wires being isolated by wood) might be preferable.

IV. As no interference with common or railroads is permitted, except under direction of the authorities, timely notice to the proper quarter would be given, if the repairing of a bridge, the laying of drains, the lowering of a hill, or any other work, likely to disturb the wires, was about to take place, when a new or temporary line of wires would be completed along the disturbed space before the old one was removed.

V. That the use of this instrument, which we will call a “detector,” may be more fully under-

stood, the following explanation and diagram is subjoined. The detector resembles a small pocket compass, with a coil of copper wire or a multiplier fixed across the dial plate from north to south, terminating at the extremities in cups for mercury; when used, the dial plate is adjusted to the magnetic meridian, so that the needle, when at rest, becomes parallel to the wire. If a current of positive electricity be passed along the wire in the direction N. S. the north pole of the magnetic needle (n) will be deflected towards the west, if in the opposite direction, the effect on the needle will be reversed, the north pole of the needle deviating to the east; let L. P. be two places between which the connection has been broken off at the point R. The telegraphic instruments at both places are so arranged that upon being set, the positive currents tend to flow from each telegraph in the direction indicated by the arrows. Whenever the detector is applied to the branch wires, it completes the galvanic



circuit either with the telegraph at L or P, accord-

ing to the side of R, on which the experiment is made: and as the right branch wire from the capital L is always placed in connection with the north cup, and the left branch wire with the south cup of the detector, it is manifest from what has been said, that so long as these experiments are made between L and R, the deviation of the north pole of the needle will be westerly, and that it will be easterly on the other side of R, thus indicating the direction of the injury.

VI. In government business, the delay occasioned by transposing the signals, might be avoided and further advantages secured, when the despatches passed through confidential hands only, by having a distinct apparatus, secured from access by lock and key, in connection with the general line of wires, in which the order of the symbols might be differently arranged, so that the signals represented on the other instruments, through which the communication passed when the government telegraph was working could have no connection with the sense of the government dispatch, which would nevertheless be expressed in the ordinary numbers, and in reference to the published signal. If any further precaution were required, a signal book differently numbered, or a supplement to the published one, containing names, important expressions, such as "war," "riot," "military," &c., might be used for further security, or a trifling

periodic change in the arrangement of the symbols, requiring only a minute or two for adjustment, would baffle the most skilful decypherer.

VII. The periodic announcement of this and other great markets would occupy but little time, for by allotting to certain important intelligence of frequent occurrence the lower numbers (say, from 10 to 99, which require only two signals to express and which would be readily recognized in practice) on the expected signal appearing about the usual time, the clerk would take up a printed form and fill up the blanks as the signals appeared. The order in the details of each report would be uniformly observed, as they would be given from a similar printed form filled up by a responsible person.

The day's report of the Stock Exchange would run as follows :—

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THE AWARD.

“As the Electric Telegraph has recently attracted a considerable share of public attention, our friends, Messrs. Cooke and Wheatstone, have been put to some inconvenience, by a misunderstanding which has prevailed respecting their relative positions in connexion with the invention. The following short statement of the facts has, therefore, at their request, been drawn up by us the undersigned Sir M. Isambard Brunel, Engineer of the Thames Tunnel, and Professor Daniell, of King’s College, as a document which either party may at pleasure make publicly known.

“In March, 1836, Mr. Cooke, while engaged at Heidelberg in scientific pursuits, witnessed, for the first time, one of those well-known experiments on electricity, considered as a possible means of communicating intelligence, which have been tried and exhibited from time to time, during many years, by various philosophers. Struck with the vast importance of an instantaneous mode of communication, to the railways then extending themselves over Great Britain, as well as to government and

general purposes, and impressed with a strong conviction that so great an object might be practically attained by means of electricity, Mr. Cooke immediately directed his attention to the adaptation of electricity to a practical system of Telegraphing; and, giving up the profession in which he was engaged, he, from that hour, devoted himself exclusively to the realization of that object. He came to England in April, 1836, to perfect his plans and instruments. In February, 1837, while engaged in completing a set of instruments for an intended experimental application of his Telegraph to a tunnel on the Liverpool and Manchester Railway, he became acquainted, through the introduction of Dr. Roget, with Professor Wheatstone, who had for several years given much attention to the subject of transmitting intelligence by electricity, and had made several discoveries of the highest importance connected with this subject. Among these were his well known determination of the velocity of electricity, when passing through a metal wire; his experiments, in which the deflection of magnetic needles, the decomposition of water, and other voltaic and magneto-electric effects, were produced through greater lengths of wire than had ever before been experimented upon; and his original method of converting a few wires into a considerable number of circuits, so that they might transmit the greatest number of signals which can be transmitted, by a given number of wires, by the deflection of magnetic needles.

“In May, 1837, Messrs. Cooke and Wheatstone took out a joint English patent, on a footing of equality, for their existing inventions. The terms of their partnership, which were more exactly defined and confirmed in November, 1837, by a partnership deed, vested in Mr. Cooke, as the originator of the undertaking, the exclusive management of the invention, in Great Britain, Ireland, and the Colonies, with the exclusive engineering department, as between themselves, and all the benefits arising from the laying down of the lines, and the manufacture of the instruments. As partners standing on a perfect equality, Messrs. Cooke and Wheatstone were to divide equally all proceeds arising from the granting of licenses, or from sale of the patent rights; a per-centage being first payable to Mr. Cooke, as manager. Professor Wheatstone retained an equal voice with Mr. Cooke in selecting and modifying the forms of the telegraphic instruments, and both parties pledged themselves to impart to each other, for their equal and mutual benefit, all improvements, of whatever kind, which they might become possessed of, connected with the giving of signals, or the sounding of alarums, by means of electricity. Since the formation of the partnership, the undertaking has rapidly progressed, under the constant and equally successful exertions of the parties in their distinct departments, until it has attained the character of a simple and practical system, worked out scientifically on the sure basis of actual experience.

“Whilst Mr. Cooke is entitled to stand alone, as the gentleman to whom this country is indebted for having practically introduced and carried out the Electric Telegraph as a useful undertaking, promising to be a work of national importance; and Professor Wheatstone is acknowledged as the scientific man, whose profound and successful researches have already prepared the public to receive it as a project capable of practical application; it is to the united labours of two gentlemen so well qualified for mutual assistance, that we must attribute the rapid progress which this important invention has made during the five years since they have been associated.

M^c I^d BRUNEL.

J. F. DANIELL.

London, 27th April, 1841.”

London, 27th April, 1841.

“GENTLEMEN,

We cordially acknowledge the correctness of the facts stated in the above document, and beg to express our grateful sense of the very friendly and gratifying manner in which you have recorded your opinion of our joint labours, and of the value of our invention.

We are, Gentlemen,

With feelings of the highest esteem,

Your obedient Servants,

WILL^m. F. COOKE.

C. WHEATSTONE.

SIR M. ISAMBARD BRUNEL, and

J. F. DANIELL, Esq., Professor, &c. &c.”

DATE DUE

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